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A DISASTER ATTRIBUTED TO WIRELESS TELEGRAPHY.

The possibility that intense electrical waves used in wireless telegraphy may cause sparks to pass between conductors where they are not expected has been pointed out, but up to this time no disaster had been attributed to this effect, as the probabilities are much against it. Now the mysterious accident which caused the blowing up of the French war vessel Jena is attributed by a French wireless expert to this cause. The reasons for the charge have not been given in full, and until they are heard, judgment must be suspended. It may, however, be pointed out that the magazine of a war vessel would be the last place where one would expect to have trouble from this source. The vessel itself is a nearly perfect metallic shield, through which no electric wave could pass. To produce sparks within a metallic hull it is necessary that the source of waves shall itself be within the same inclosure, and even then the bulkheads should, under normal conditions, be effective screens.

CONDUCTION OF ELECTRICITY IN METALS.

The most familiar method of electrical conduction is that through metals. This method was the first to yield to scientific analysis sufficiently to enable a general law to be enunciated, which took into consideration all the usual factors. Yet Ohm's law, it should be remembered, is wholly empirical and the relations it expresses are so simple that it offers to the student who would go deeper into the matter few points for attack. Moreover, the known phenomena of metallic conduction are few and at first appear relatively simple, a condition which further acted to make difficult the acquisition of more knowledge. In fact, recent investigations into metallic conduction have been suggested by work in a quite different field, and are merely attempts to adapt to the former theories propounded after much research in the latter, a field that was, itself, neglected for many years. To-day it is most interesting and instructive to trace the way in which we have come to our present knowledge and ideas of the ways in which conduction takes place. Although the phenomena accompanying conduction through the three forms of matter were known, that in which the molecules of the material were most restricted was the first, and possibly for this very reason, to yield to analysis. But this analysis, while it gave us a fundamental law, did not go deeply into the matter. It told us the amount of conduction, but not the method. Then the next form of matter, liquids, came up for study, and here, too, certain fundamental but empirical laws were deduced. How-

ever, the molecules of matter in liquid form are freer to move than those in solids, and the phenomena accompanying conduction are more diverse and involve results which are not simply electrical. Hence, it became necessary to evolve some theory of the way in which the conduction actually took place in order to coordinate the various effects. Theory after theory was propounded, each an attempt to adapt our old ideas to new knowledge; and the process is still going on. But a significant result of this development of ideas was the emphasis laid upon the unsatisfactory condition, so far as theory was concerned, of metallic conduction. Naturally, it was attempted to apply the newer ideas to metals, but not much success could be claimed.

The next step was when the study of conduction through gases was taken up in earnest, and here the results of the work in electrolytic conduction aided mightily both in pointing out lines of attack and in arriving at an adequate idea of the mechanics of the process of conduction through matter in its least confined form. Here, again, the phenomena are still more diverse, and hence have led to theories much broader than any previously proposed, and we seem at last in a position to attack intelligently what seemed before to be the simplest case, though it may eventually be shown to be the most complex, metallic conduction.

The work in this field has been carried on by various investigators who have studied the different phases suggested by the theories of gaseous conduction, and it has not been easy to keep track of all that has been done. Therefore Dr. J. J. Thomson performed a most acceptable service when, in a recent lecture before the Institution of Electrical Engineers of Great Britain, he explained what has already been done, and showed how the different results fit together, and in what way the general theory of conduction through gases might be modified to apply to conduction in solids. Incidentally Dr. Thomson drew a much-needed distinction between the terms "corpuscle" and "electron." When used correctly, these terms have identical meanings, but he prefers the former, not merely because he is its father, but because the latter emphasizes the electrical properties of the particles, and hence has been used, with a suitable modifying term, to designate the positively charged portion of an atom, and this use has led many to assume that the only difference between the so-called positive and negative electrons is the polarity of the charge each has, while, so far as is known, the corpuscle and the positively charged portion of the atom are totally different.

The early attempts to evolve a satisfactory theory all attributed the conduction of electricity through metals to the movement of small charged particles, but the first notable step was taken by Thomson, when he limited this action to the negatively charged particles, or corpuscles, which were supposed to be split off by some action of one atom upon another. If the positively charged portion of the atom, assuming this to be merely an atom less a corpuscle, took part in the conduction, its movement could be observed, yet no such action has been detected.

If conduction is due to corpuscles diffused throughout the metal, and more or less free to move, these free particles should obey the laws deduced from the thermodynamic theory of gases. An expression for the conductivity of a metal may then be deduced, in terms of number, of free corpuscles.

These corpuscles must be in temperature equilibrium with the neighboring atoms, and hence, where a difference of temperature exists, the energy of corpuscles in the hotter region will be greater than in the cold and there will be a tendency for a flow of this excess energy to the cooler region. This argument suggested that a relation between thermal and electrical conductivity might be established, and Drude has done this and has shown that the relation does not involve any peculiarities of the metal itself—in other words, the ratio of the two conductivities should be a constant for all metals. Some remarkable results have been obtained which are in agreement with the theory so far, though owing possibly to difficulties of experimentation, others were not so satisfactory.

Another important investigation has been made by Lorentz, in which he endeavored to connect the radiation from a body with the number of corpuscles it contains, and here again the peculiarities of the metal disappear. This investigation could be but incomplete, due to the extreme complexity of the problem; nevertheless it has led to important results. It seems from this that thermal radiation is merely radiation from one layer of the metal to the next, merely a special form of Röntgen rays.

This simple theory of the free corpuscles is adequate to explain other phenomena, such as the Peltier effect, but in other directions difficulties are met. For example, according to the thermodynamic theory, the specific heat of a body goes to imparting motion to the molecules. The corpuscles must also be brought up to the new temperature, but if they are free, the heat required to do this is much in excess of the known specific heat. Thomson therefore assumes that the corpuscles are not entirely free, but are associated with atoms, and only become free momentarily when some action causes them to pass from one atom to the next. This might be done by internal collisions or external forces. Under normal conditions each corpuscle is associated with an atom and the couples lie pointing in all directions. There is therefore no resulting flow of corpuscles in any direction, due merely to atomic collisions. But as soon as a directive force is applied the couples become oriented, a difference of potential appears and a resultant movement of corpuscles may take place, this constituting a current of electricity. The resemblance of this theory to that put forward by Grotthus to explain electrolytic conduction is striking.

This modification of the simpler theory of free corpuscles also offers an explanation of the Hall effect, which the earlier theory does not. If the Hall effect were always in one direction the free corpuscle theory would answer, as the motion of free charged particles through a magnetic field would cause them to deflect to one side. But the Hall effect changes sign for different metals and is sometimes different in the same metal if the magnitude of the force be changed. Assuming, however, Thomson's modification of the theory, the two forces, acting on the

atomic couples, would give rise to rotation and bring in a gyroscopic effect which would tend to deflect the couple to one side or the other of the line of force, depending upon the direction of rotation, and consequently a difference of potential would be set up at right angles to the original current.

This theory, with Thomson's modification, more nearly meets all requirements than any other yet suggested, but it is evident that it gives us an idea of metallic conduction which is far from simply that flow of current we so often liken to a flow of water through a pipe.

RULES FOR RHEOSTATS.

In the issue of the ELECTRICAL REVIEW for March 16 attention was called editorially to a meeting of the electrical committee of the Underwriters' National Electric Association, to be held in New York city, March 27 and 28, at which a large number of proposed changes in rules will be considered. It was pointed out that the general policy is one rather of making haste slowly, and not changing the rules essentially in any point without good reason.

One of the proposed changes which is arousing a good deal of interest is that relating to starting rheostats. This is a subject about which few persons know much; in fact, it is rather difficult to get any reliable data on the subject. It is not a difficult matter to design a rheostat for starting a motor properly—that is to say, for limiting the current which will pass into the motor; but it is a different matter to proportion it so that the rheostat itself will not be unduly expensive nor introduce a danger of fire. Such information is not hard to obtain, provided there are rheostats in plenty to be had; but few engineers can undertake to test these devices to destruction, which is, of course, the proper way of testing the fire hazard.

The proposed changes have all been well considered, but they will be even more carefully reviewed before they are adopted. In such matters the underwriters have final say, but their policy of consulting all allied interests is one which can not fail to give confidence in any decision which they reach.

LAMP FIXTURES.

It is very encouraging to note the interest which architects and illuminating engineers are taking in electric light fixtures. Although it has been pointed out again and again that the design of fixtures has been left almost entirely to the fixture manufacturers, who have generally branched out into this business from that of making gas fixtures, no concentrated effort has been made to overcome the objections to which this has led. It has generally been thought entirely satisfactory if a gas fixture be modified so that a lamp socket could be attached to it in place of the ordinary burner. Then some slight modifications, such as turning the lamp down, have been attempted, but no radical departure from the old ideas was made.

Along with this unfortunate condition was another: little attention was paid to directing the light produced by the lamps so as to get the desired effect. A lamp was placed in the socket, and if it did not give enough light in the direction desired, other lamps were added. Shades were frequently provided, but they were purely ornamental and useless for improving the illumination. Occasionally some very beautiful designs for electroliers have been seen, but too frequently they were merely ornamental structures which might just as well have been fitted with gas burners. In other words, little or no attempt was made to take advantage of the characteristics of the incandescent lamp other than to enclose it in an ornamental globe.

It is therefore very pleasing to find a healthy interest now being taken in these two phases of illumination. Architects and illuminating engineers are making their own designs for lighting fixtures, and are not restricted by the past history of gas lighting. And they are devoting a great deal of care to the selection of shades and reflectors which give the distribution of light desired for each room.

There is room here for the exercise of a great deal of taste and ingenuity, not only in the design of fixtures, but of shades; and there is a large and growing class interested to learn of the actual results obtained from any place where special attention has been given to the question of illumination. Data on this subject are, as yet, all too scarce.

SMALL ELECTRICAL APPLIANCES.

A few years ago a topic of considerable interest, particularly at this time of the year, was the popularity of the fan motor. This little device has indeed brought comfort to many a heated office or living room and made endurable monotonous and confining work during the hottest weather.

But the electric motor has not stopped here, for it has extended its sway in other ways, and now can bring still more comfort and in many ways relieve us of much of the everyday drudgery. Certain of these applications, particularly those for business offices, are of service throughout the entire year, but it will be during the hottest days that they are most appreciated.

Moreover, in the home the motor is now available for bringing summer comforts, and electric cooking utensils are then at their best. Gas, it is true, is far superior to the ordinary coal stove for summer use, as it is only burned while needed; but, convenient though it is, it is comparatively wasteful of heat in the process of cooking. It is just here that the electric heater shows its great superiority. Practically all of the heat it develops is taken up by the article being cooked.

And in other ways the electric motor is making summer less trying. This is particularly true of an application of recent years, that of automatic refrigerating machines. These are nothing more than small compressors driven by a motor, which automatically control the temperature of the refrigerator. They give a much more uniform temperature than can be obtained by means of ice, doing away with all the nuisance caused by the latter, and, moreover, they may be regulated to give any desired temperature.

CHOICE OF FREQUENCY.

BY CHARLES F. SCOTT.

Choice often must be made between sixty cycles and twenty-five cycles for general purposes. In many cases there is little difference in so far as generator speeds, transmission losses, motors and incandescent lighting are concerned. A change to fifteen cycles is more serious. Speeds of generators and of induction and synchronous motors and of rotary converters can now be only 900, 450, 300, 225 and 180 revolutions per minute, or less. The highest speed, 900 revolutions per minute, requires a two-pole winding, which is apt to be more expensive than multipolar windings. These speeds are in general lower than are desirable for turbo-generators or for induction motors. Transformers cost more, and incandescent lamps must be made for very low voltage. Aside from trolley circuits and motors there seems little or no reason to favor low frequency.

A twenty-five-cycle standard single-phase railway motor will run on fifteen cycles with an increased output of some fifteen or twenty per cent. A fifteen-cycle motor having the same weight as a twenty-five-cycle motor has about thirty per cent to forty per cent greater output, with higher efficiency and power-factor. A fifteen-cycle locomotive, or a fifteen-cycle multiple-unit train, having the same power in motors as twenty-five-cycle equipments, will have better performance and lower cost. But these are not all. Permissible lengths of rigid wheel base and diameters of driving wheels of locomotives and the ordinary sizes of car trucks place a limit on motor dimensions. The low frequency enables larger output to be secured within given dimensions. Hence capacity as well as cost is a factor.

If the problem is considered as relating simply to the operation of heavy trains by single-phase motors, fifteen cycles has little opposition. The estimated increase of ten per cent in turbo-generator cost is quickly wiped out by the less cost of motors. Troubles come when the side issues appear. The lower frequency is not so useful for running stationary induction motors nor for station and car and shop lighting; it does not permit convenient power supply from twenty-five-cycle plants. The best frequency in a particular case depends upon the relative importance of the motor equipments and of the other things. In the beginning when the traction element has less relative importance than it may have later there will often appear strong reasons for adopting twenty-five cycles. In such cases the probability of future extensions and inter-traffic with fifteen-cycle loads must be taken into account. Fortunately, fifteen-cycle equipments may run from a twenty-five-cycle trolley, though with decreased capacity, and twenty-five-cycle equipments may be operated from fifteen cycles, provided the transformers be designed for the lower frequency. Again, twenty-five-cycle motors and transformers can without modification be operated at reduced capacity on fifteen cycles if the trolley circuit have about two-thirds the voltage used on twenty-five cycles. This method may be useful on some occasions as an emergency expedient. Frequency changers may be placed between twenty-five cycle or sixty cycle and low frequency circuits. Aside from objections of cost and losses, they have several merits. The transmission may be three-phase, at a uniform and high power-factor and the single-phase low-frequency current may have an independent voltage control. This would avoid a single-phase fluctuating load with variable power-factor on the three-phase system. Frequency changers need not be placed in all substations. The low-frequency current may be transmitted to transformer substations.

Altogether, therefore, it is evident that the question of frequency is by no means a simple one, if considerations aside from the motors are deemed important. The general discussion of the broad question is quite timely. From the standpoint of the railroad the question is substantially this—Is the problem purely a traction problem? If it is, fifteen cycles is the recommended frequency. If it is not, if other features of the situation make it convenient to take current from a twenty-five-cycle system, then the proper course to pursue is not always obvious.—*The Electric Journal.*

Large Utah Power Development.

F. W. C. Hathenbreuck and Sidney Bamberger have filed application with the state engineer for sixty-four second-feet from the Green river in Wasatch county, to develop 40,000 horse-power for furnishing power and light in Park City, Bingham, Salt Lake, Utah, and other places. The same parties also filed application for twenty-six second-feet from the Green river in Wasatch county, for the development of 800 horse-power, with which to drive stamp mills and mining machinery in Wasatch county mines operated by the applicants.

Cooper Hewitt Electric Company Upheld in German Patent Controversy.

In the matter of the patent controversy of Hans Boaz, of Berlin, Germany, complainant, *versus* the Cooper Hewitt Electric Company, of New York city, the patentee of patent No. 140,364, relating to "an electric lamp with conducting gas or vapor column," defendant, the Imperial Patent Office, nullity department, after an oral hearing, decided, at its meeting on January 17, 1907, that the complaint be denied, the costs of the proceedings to be charged to the plaintiff. There were present at the meeting Director Dr. Rhenius, as president; Privy Councillor Birkenfeld, Privy Councillor Professor Dr. Nebel, Professor Dr. Jaeger and Civil Engineer Dr. Mullendorf as associates.

The plaintiff contended that the defendant used a known construction, and ascribed to this construction a function which had been previously understood. The contention was also made that the subject matter of the patent is no invention, because, at the date of the application, the subject matter was no longer new. The plaintiff contended that the lamps exhibited by the defendant in the patent application had been shown and described in public prints prior to the application for the patent. Cooper Hewitt, the plaintiff contended, might perhaps have made the Arons lamp more convenient for technical use by alterations, without, however, by this means alone giving the lamp technical availability.

The defendant urged that Cooper Hewitt was the inventor of the mercury arc lamp as an illuminating means. Arons and others had recognized that mercury vapors traversed by electric current lighted up, but they were not able to state how a commercially useful lamp could be made on this basis. The elimination of artificial cooling means and the establishment of a practical and commercially useful lamp were urged by the defendant in establishing the validity of the patent.

The decision of the meeting rejected considerable of the proof cited by the plaintiff and held that the lamps of Arons and Lummer served exclusively for scientific researches and demonstrations, and required, in addition, water cooling. The lack of effectual priority on the part of other investigators appeared to be well established, and under this state of facts the complaint was denied. The decision is signed by Rhenius, Birkenfeld, Mullendorf, Jaeger and Nebel.

The Cazadero Power Plant of the Portland (Ore.) Railway, Light and Power Company.

BY THE installation of a 25,000-horse-power plant on the Clackamas river, a mountain stream thirty-five miles from Portland, Ore., the Portland Railway, Light and Power Company has again doubled its capacity for furnishing electric current to Portland and vicinity. In less than two years the power generated by this company has been increased from 12,000 to approximately 40,000 horse-power, which will become 50,000 horse-power on the installation of two more units of 5,000 horse-power each, for which the new plant on the Clackamas is laid out. Prior to 1905 the company operated only station B, at Oregon City Falls, generating 12,000 horse-power. About a year ago it completed a steam plant in North Portland, burning sawmill refuse and generating 11,000 horse-power. The Clackamas river development at Cazadero, just completed, is the largest and most economical of its three developments, giving immediately three additional units of 5,000 horse-power each. The capacity will shortly be increased to 25,000 horse-power by the installation of two more machines, for which places are provided in the power-house. Another small steam plant owned and operated by the company at Boring, supplying current for its electric railroad to Estacada, generates 2,500 horse-power.

DAM AND FLUME AT CAZADERO OF THE PORTLAND RAILWAY, LIGHT AND POWER COMPANY, UNDER CONSTRUCTION.

Ownership of these combined power plants now rests in the corporation that is known as the Portland Railway, Light and Power Company, a holding company for the stocks of the Portland General Electric Company, the Portland Railway Company and the Oregon Water Power and Railway Company. It is a $30,000,000 concern, formed last year by Clark Brothers, of Philadelphia, Pa., and the Seligmans, of New York, and at the present time embraces all electric power and street railway operations in Portland. H. W. Goode, president of the company, has announced that plans have been accepted for construction of a union passenger station for the street-car and interurban lines. The building will cost $1,000,000, and will be one of the most modern street railway buildings in the United States.

F. G. SYKES, GENERAL MANAGER, DEPARTMENT OF ELECTRICITY, PORTLAND RAILWAY, LIGHT AND POWER COMPANY.

The watershed of the Clackamas river, with its tributaries, is about 900 square miles. Its waters during the summer and low-water months are kept up by the melting snows in the mountains, where the sources of its main feeders are.

At the headworks, 1.7 miles above the Cazadero plant, is a dam originally designed to be a wedge-shaped structure, built of rough logs about two feet in diameter, laid across, and lengthwise of, the stream in such a way as to form vertical pockets from ten to twenty feet square. These pockets were filled with broken rock and clay. A section of the

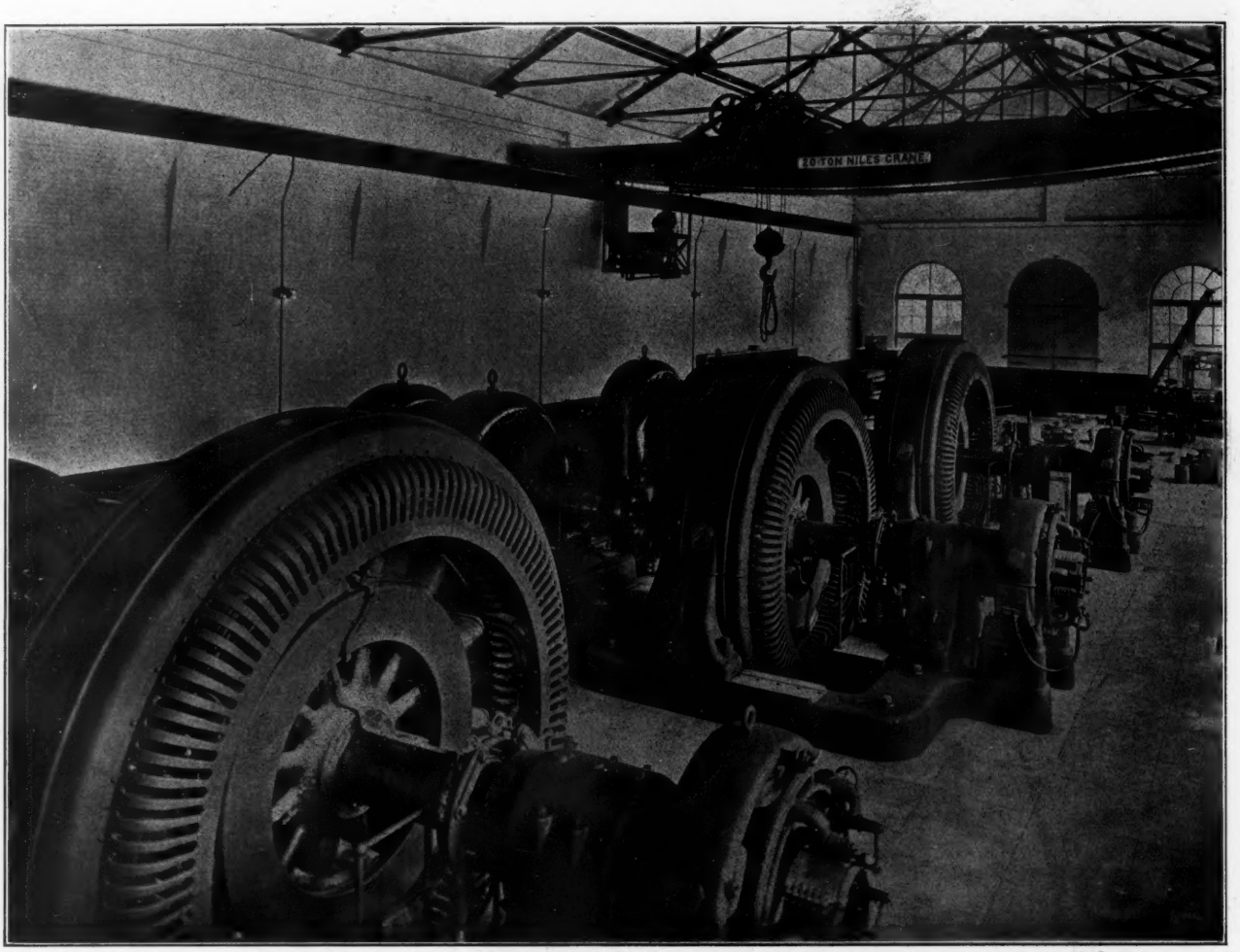
dam was carried out by flood last year, before being completed. Later the dam was strengthened by means of a rock-fill and crib work. The length of the main body of the new crib is 120 feet, and its bottom width forty feet. It is sixty-five feet high, and rests on bedrock, to which it is securely anchored. The dimensions of the dam proper are 176 feet width of base; length, 230 feet on base, while the length over all is 400 feet. The water spillway between the bulkheads is 153 feet wide and fifty-one feet high above low water. The dimensions of the bulkheads confining the water to the spillway are sixty feet long and forty-three feet wide for the one on the east side, and fifty-seven feet long and thirty-five feet wide for the one on the west side.

The flume is built upon a crushed-rock foundation. This flume follows the contour of the hillside along the river for a distance of 2,622 feet, where it empties into a ditch through a concrete outlet. The bottom width of this ditch is thirty-five feet, its depth twenty-two feet. The total length of the ditch to its outlet into the reservoir is 2,898 feet.

The reservoir from which the water is taken directly to the water-wheels, and which is supplied at its upper end from the ditch, covers an area of fifty acres when filled to an average depth of twenty feet. At this level the lake will supply power sufficient to run the wheels to their capacity for about six hours after the gates at the dam have been closed.

The forebay gates are set into a massive steel concrete wall built on the top edge of the river bluff. The spillways are provided with sectional gates, so that it is possible to keep the lake level at whatever height desired. This steel-concrete wall, eight feet thick at the top and twenty feet thick at the bottom, rests upon a foundation forty-seven feet wide, built upon sandstone bedrock. A steel-concrete core wall four feet thick at the bottom and two feet thick at the top extends from the main dam or wall for forty feet into the earth embankment of the lake.

The distance from the top of the main wall to the foundation is thirty-three feet and the length of the main wall is 290 feet. At one extremity it joins the lake embankment, while at the other it enters the hillside rock. The foundation upon which the main wall rests extends upstream twenty-seven feet beyond the gates, which slide vertically against the upstream face of the wall. These gates are also arranged to be operated either by hand or by power, and when operated by power may be controlled from the power-house.



Generators and Water-Wheels in Cazadero Power-House of the Portland Railway, Light and Power Company.

As at present but three units are in use, the two remaining gate openings have been closed with timber gates. To prevent carrying drift and other foreign matter into the wheels, iron racks have been placed in front of the gates.

When the water passes through the forebay gate openings, which are each nine feet in diameter, it enters long steel tubes eight feet in diameter, with inlet ends enlarged to nine feet, which rest upon a concrete web and cross-wall arrangement and are inclined at an angle of about

forty-five degrees along the hillside. One of these penstocks is provided for each gate, and at its lower end connects directly with a pair of Platt Iron Works horizontal, double-turbine water-wheels located in the power-house. These wheels, each pair of which, under a total head of 125 feet, develop 5,000 horse-power, will, as they are now installed, have a head of 138 feet at low water.

Attached to each water-wheel shaft is a 10,000-volt, three-phase Bullock generator and a small dynamo used as an exciter. Besides the governor, each wheel is provided with a safety device for the prevention of damage from excessive water thrust should the gate close too suddenly. The wheels and generators are set on a massive concrete foundation, eliminating vibration when running at full speed.

The power-house is a well-lighted, thoroughly ventilated building, 180 feet long and fifty-four feet wide. Clusters of incandescent lamps are placed between the windows at a height of twelve feet from the floor and others below them at a distance of six feet from the floor.

From the power-house the current passes through General Electric type H oil switches on three wires across the Clackamas river to the transformer house, a substantial brick structure, where it is stepped up to 30,000 volts, and through 60,000-volt solenoid-operated Stanley switches is transmitted thirty-five miles to Portland on two No. 00 copper wires. At a transformer house in Portland it is stepped down to 10,000 volts for commercial distribution. There is also a No. 1 copper wire of 10,000 volts capacity leaving the power-house and following the electric railroad line to Portland. The various substations along the line are supplied from this wire.

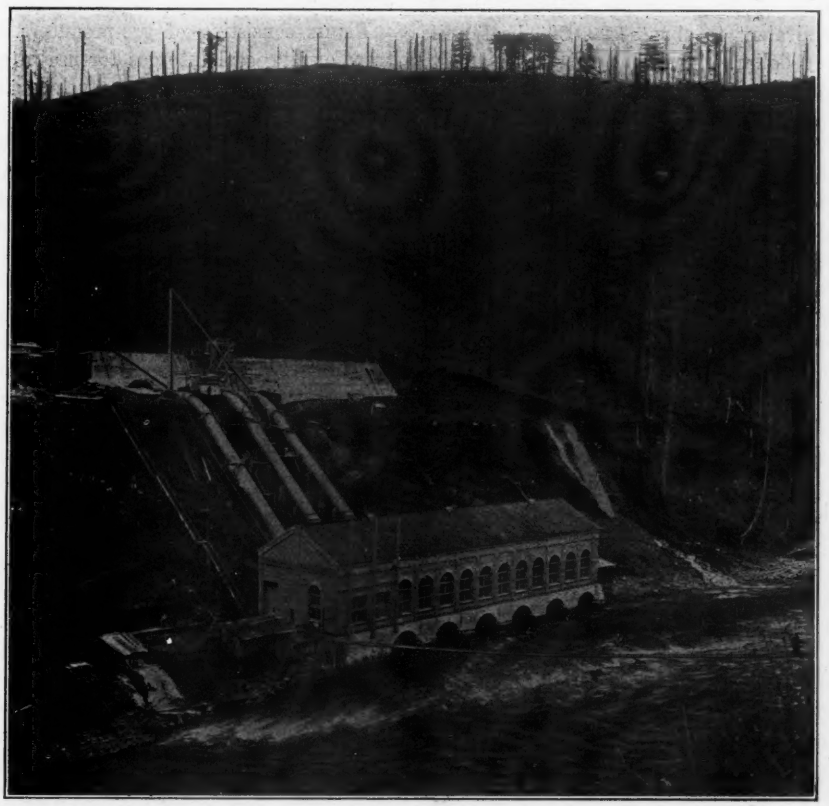
A twenty-ton electric traveling crane, which can be run the full length of the building, facilitates any repair work that might be necessary, and a railway spur terminates inside the power-house, so that any loading or unloading of heavy machinery can be done by means of this crane.

F. G. Sykes, general manager of the light and power department of the Portland Railway, Light and Power Company, has been in general charge of the entire work, and with the engineers in direct charge of the various features of construction, has assisted in carrying the Cazadero plant to completion.

T. W. Sullivan, hydraulic engineer of the Portland Railway, Light and Power Company, has had charge of the construction of the dam, reservoir and all hydraulic work connected with the new plant.

The electrical construction and operation of the plant is in charge of O. B. Coldwell, operating engineer of the company, while the work of constructing the lines for the transmission of current to Portland is in the hands of H. S. Sladen, the transmission engineer.

The formal opening of the Cazadero plant, which took place on February 26, was attended by about 200 business men of Portland, the current being turned on by Mayor Lane. At a banquet given by President Goode, at the Estacada Hotel, following the ceremony, there were toasts and responses by many well-known citizens.



THE CAZADERO POWER-HOUSE OF THE PORTLAND RAILWAY, LIGHT AND POWER COMPANY.

Pennsylvania Railroad Experimenting with Noiseless Elevated System.

A leading feature in the plans of the Pennsylvania Railroad, which is about completing its elevation of tracks and passenger station in Wilmington, Del., is the special effort made to reduce to a minimum the annoyance to persons living or doing business near the tracks. In the new work there are twenty-four bridges, carrying the main tracks over street and railroad crossings. The floors of the bridges are of steel, and of the form known as solid trough construction. The steel work is covered with concrete, which is thoroughly waterproofed with five layers of felt and asphalt compound. This, in turn, is covered with a layer of protecting bricks laid in sand and grouted. Upon the brick is tamped the stone ballast carrying the wooden ties and the rails forming the roadbed. If this form of construction accomplishes what is expected of it, it will be used at other places where similar improvements are being made.

The "Tellevent."

A company has been organized, known as the American Tellevent Company, at Detroit, Mich., to exploit the invention of J. F. Land, general manager of the Michigan State Telephone Company. This apparatus, it is stated, will supply subscribers at their homes with the latest happenings of the world, with special music, performances at theatres, concerts and churches.

The company is capitalized at $300,000, and the temporary organization for incorporation purposes is as follows: E. L. Ford, W. A. Jackson, George M. Black, A. A. Schantz, James H. Swart and James F. Land.

The Use of Alcohol and Gasolene in Farm Engines.

The United States Department of Agriculture has published in Farmers' Bulletin No. 277 a very complete report, entitled "The Use of Alcohol and Gasolene in Farm Engines," by Charles Edward Lucke, assistant professor of mechanical engineering, Columbia University, New York, and S. M. Woodward, irrigation engineer, office of experiment stations, Washington, D. C. This report includes chapters on "Sources of Power," "Comparative Cost of Power from Different Sources," "Comparative Cost of Energy in Different Fuels," "Thermal Efficiency," "Adaptability of Various Types of Engines," "First Use of Alcohol Engines," "Elementary Engine Mechanism," "Explosive Mixtures—Limits of Proportion, Temperature of Ignition, Rate of Propagation, Pressure Due to Explosion," "Liquid Fuels," "Heat of Combustion," "Air Necessary for Combustion," "Vaporization of Fuel," "Effect of Initial Compression" and "Practical Experience with Alcohol Engines in Germany."

The following abstracts are of general interest:

The newest fuel for power purposes is alcohol. This is made from the yearly crops of plants. There is in existence no natural deposit of alcohol, but in a sense it may be said to be possible to produce inexhaustible supplies.

It is only within recent time that engineers have known how to build engines that would produce power from alcohol; and still more recent is the further discovery by engineers that this power can be produced at a cost which may permit its general introduction.

The cost of fuel per unit of power developed depends first, on the market price of that fuel at the point where it is to be used, and next, but by no means least, on the ability of the machinery to transform the fuel energy into useful work. If all the different kinds of machinery used for power generation could turn into useful work the same proportion of the energy in the fuel, coal would be almost universally used, because of the present low cost of energy in this form.

Anthracite coal in the neighborhood of New York can be bought in small sizes in large quantities for power purposes at about $2.50 per ton. This coal will contain about 12,500 B. T. U. per pound. This is equivalent to about 10,000,000 heat units per dollar. Large sizes, such as egg coal, containing about 14,000 B. T. U. per pound, can be bought in large quantities for about $6.25 per ton, which is equivalent to 4,500,000 B. T. U. per dollar. Other grades of anthracite coal and the various grades and qualities of bituminous coal will lie between these two limits of cost. Illuminating gas in New York costs $1 per 1,000 cubic feet, which is equivalent to about 500,000 heat units per dollar. Natural gas in the Middle States is sold for 10 cents per 1,000 cubic feet and upward. This fuel at the minimum price will furnish about 10,000,000 heat units for a dollar. Crude oil sells in the East at a minimum price of four cents per gallon, which is equivalent to about 4,000,000 heat units per dollar. Gasolene sells at a minimum price of ten cents per gallon, which is equivalent to about 1,200,000 heat units per dollar. Kerosene sells from ten to thirty cents per gallon, which is equivalent to 1,200,000 and 400,000 heat units per dollar, respectively. Grain alcohol, such as will be freed from tax under the recent legislation, will sell for an unknown price; but for the purpose of comparison, assuming thirty cents per gallon as a minimum, it will give 270,000 heat units per dollar. Gasolene, kerosene, crude oils, and, in fact, all of the distillates have about the same amount of heat per pound; therefore, at the same price per gallon, ignoring the slight difference in density, they would deliver to the consumer about the same amount of heat per dollar, whereas the other liquid fuel, alcohol, if sold at an equal price, would give the consumer only about three-fifths the amount of heat for the same money. From the figures above given it appears that the cost of heat energy contained in the above fuels, at the fair market prices given, varies widely, lying between 200,000 heat units per dollar and 10,000,000 heat units per dollar. It is possible to buy eight times as much energy for a given amount of money in the form of cheap coal as in the form of low-priced gasolene, or twenty-five times as much as in the form of high-priced gasolene or kerosene. This being true, it might seem to a casual observer as rather strange that gasolene should be used at all, and the fact that it is used in competition with fuel of one-eighth to one-twenty-fifth its cost shows clearly that either the gasolene engine has some characteristics not possessed by an engine or plant using coal, which makes it able to do things the other can not do, or that more of the heat it contains can be transformed into energy for useful work. Both of these things are true.

Large steam plants in their daily work seldom use less than two pounds of poor coal per hour for each useful horse-power (known as a brake horse-power), which is equivalent to about 25,000 B. T. U. per hour, and which corresponds to about ten per cent thermal efficiency. Small steam plants working intermittently, such as hoisting engines, may use as high as seven pounds of coal per brake horse-power, which is equivalent to about 100,000 heat units per brake horse-power, or 2.5 per cent thermal efficiency. Some plants will do better than the above with proper conditions, and some may do worse, but in general it may be said that the performances of steam plants lie between the limits of 2.5 and ten per cent thermal efficiency.

Plants consisting of gas-producers for transforming coal into gas for use in gas engines have in general a much higher thermal efficiency than steam plants doing the same work. They are, however, not built quite so small as steam plants, the smallest being about twenty-five horse-power, and in general they have not been built so large, the largest being only a few thousand horse-power. Their efficiency, however, does not vary so much as is the case with steam plants. It may be fair to say that under the same conditions as above outlined these plants will use one and one-quarter to two pounds of coal of fair or poor quality per brake horse-power hour, which gives a thermal efficiency ranging from eighteen to ten per cent. These plants can be made to do much better than this, and perhaps may do worse, although the variation is not nearly so great as for steam plants.

Gas engines operating on natural gas or on illuminating gas from city mains will, on fluctuation of load with the regular work, average about 12,000 heat units per brake horse-power hour, or twenty per cent thermal efficiency. Exploding engines operating on crude oil will average about 25,000 heat units per brake horse-power hour, which is equivalent to about ten per cent thermal efficiency. Exploding engines using gasolene should operate at a thermal efficiency of about nineteen per cent under similar operating conditions.

The efficiency of an alcohol engine may be assumed at this time to be unknown, but as alcohol can be burned in engines designed for gasolene, it may be assumed that such an engine will have with alcohol fuel the same thermal efficiency as with gasolene, to wit, nineteen per cent for fair working conditions.

From the above brief discussion of the efficiency of different methods of power generation from different fuels it appears

that quite a range is possible, though not so great a range as exists in the case of cost of fuel energy. Efficiency is seen to lie somewhere between two and one-half and twenty per cent for all the fuels under working conditions. It is known that actual thermal efficiency under bad conditions may be less than one per cent and under the best conditions as high as forty per cent, but these are rare and unusual cases. The range given is sufficient to indicate that a highly efficient method may make the fuel cost per unit of power less with quite expensive fuel than it would be with cheaper fuel used in a less efficient machine. It is also perfectly clear that without proper information on the efficiency of the machine or the efficiency of the plant it is impossible to tell what the cost of fuel per horse-power hour will be, even though the price of the fuel per ton or per gallon be known. From the figures given on the cost of fuel and a fair average for plant efficiency the cost of fuel per horse-power hour is computed as given in the following tables:

COST OF ENERGY IN FUELS.

Kind of Fuel.	Cost of Fuel.	British Thermal Units (B. T. U.)	Number of B. T. U. Bought for $1.
Small anthracite	$2.50 per ton	12,500 per pound	10,000,000
Large anthracite	6.25 "	14,000 "	4,500,000
Illuminating gas	1.00 per 1,000 cubic feet	550 per cubic foot	550,000
Natural gas	.10 per 1,000 "	1,000 per " "	10,000,000
Crude oil	.04 per gallon	20,000 per pound	3,650,000
Kerosene	.10 "	20,000 "	1,200,000
"	.30 "	20,000 "	400,000
Gasolene	.10 "	20,000 "	1,200,000
"	.30 "	20,000 "	400,000
Grain alcohol	.30 "	12,000 "	270,000
"	.40 "	12,000 "	200,000

FUEL COST OF POWER

Fuel and Type of Plant.	Fuel Required per Horse-Power per Hour.	British Thermal Units Required per Horse-Power Hour.	Thermal Efficiency. Per Cent.	Cost of Fuel.	Cost of Fuel per Horse-Power per Hour.
Anthracite coal:					
Large steam plant	2 pounds	25,000	10	$2.50 per ton	$0.25
" " "	2 "	25,000	10	6.25 "	0.57
Small steam plant	7 "	100,000	2½	2.50 "	1.00
" " "	7 "	100,000	2½	6.25 "	2.20
Producer gas plant	1¼ "	14,000	18	2.50 "	0.14
" " "	1¼ "	14,000	18	6.25 "	0.31
" " "	2 "	25,000	10	2.50 "	0.25
" " "	2 "	25,000	10	6.25 "	0.57
Illuminating gas	24 cubic feet	12,000	20	1.00 per 1,000 cu.ft.	2.20
Crude oil	1.4 pints	25,000	10	0.04 per gallon	0.68
Gasolene	1.1 "	13,400	19	0.15 "	1.70
"	1.1 "	13,400	19	0.30 "	3.40
Alcohol	.....	.....	a 19	0.30 "	5.00
"	.....	.....	a 19	0.40 "	6.70

a Efficiency of alcohol is assumed to be the same as that of gasolene for identical conditions of use.

The following conclusions regarding the use of alcohol as fuel for engines as compared with gasolene are based on the preliminary results of the department's experiments, upon results of the European experiments and investigations which have been presented in the foregoing pages, and upon the general knowledge of the author:

(1) Any engine on the American market to-day, operating with gasolene or kerosene, can operate with alcohol fuel without any structural change whatever with proper manipulation.

(2) Alcohol contains approximately 0.6 of the heating value of gasolene, by weight, and in the department's experiments a small engine required 1.8 times as much alcohol as gasolene per horse-power hour. This corresponds very closely with the relative heating value of the fuels, indicating practically the same thermal efficiency with the two when vaporization is complete.

(3) In some cases carbureters designed for gasolene do not vaporize all the alcohol supplied, and in such cases the excess of alcohol consumed is greater than indicated above.

(4) The absolute excess of alcohol consumed over gasolene or kerosene will be reduced by such changes as will increase the thermal efficiency of the engine.

(5) The thermal efficiency of these engines can be improved when they are to be operated by alcohol, first by altering the construction of the carbureter to accomplish complete vaporization, and second, by increasing the compression very materially.

(6) An engine designed for gasolene or kerosene can, without any material alterations to adapt it to alcohol, give slightly more power (about ten per cent) than when operated with gasolene or kerosene, but this increase is at the expense of greater consumption of fuel. By alterations designed to adapt the engine to new fuel this excess of power may be increased to about twenty per cent.

(7) Because of the increased output without corresponding increase in size, alcohol engines should sell for less per horse-power than gasolene or kerosene engines of the same class.

(8) The different designs of gasolene or kerosene engines are not equally well adapted to the burning of alcohol, though all may burn it with a fair degree of success.

(9) Storage of alcohol and its use in engines is much less dangerous than that of gasolene, as well as being decidedly more pleasant.

(10) The exhaust from an alcohol engine is less likely to be offensive than the exhaust from a gasolene or kerosene engine, although there will be some odor, due to lubricating oil and imperfect combustion, if the engine is not skilfully operated.

(11) It requires no more skill to operate an alcohol engine than one intended for gasolene or kerosene.

(12) There is no reason to suppose that the cost of repairs and lubrication will be any greater for an alcohol engine than for one built for gasolene or kerosene.

(13) There seems to be no tendency for the interior of an alcohol engine to become sooty, as is the case with gasolene and kerosene.

(14) With proper manipulation, there seems to be no undue corrosion of the interior due to the use of alcohol.

(15) The fact that the exhaust from the alcohol engine is not as hot as that from gasolene and kerosene engines seems to indicate that there will be less danger from fire, less offense in a room traversed by the exhaust pipe, and less possibility of burning the lubricating oil. This latter point is also borne out by the fact that the exhaust shows less smokiness.

(16) In localities where there is a supply of cheap raw material for the manufacture of denatured alcohol, and which are at the same time remote from the source of supply of gasolene, alcohol may

immediately compete with gasolene as a fuel for engines.

(17) If, as time goes on, kerosene and its distillates become scarcer and dearer by reason of exhaustion of natural deposits, the alcohol engine will become a stronger and stronger competitor, with a possibility that in time it may entirely supplant the kerosene and gasolene engines.

(18) By reason of its greater safety and its adaptability to the work, alcohol should immediately supplant gasolene for use in boats.

(19) By reason of cleanliness in handling the fuel, increased safety in fuel storage, and less offensiveness in the exhaust, alcohol engines will, in part, displace gasolene engines for automobile work, but only when cost of fuel for operation is a subordinate consideration. In this field it is impossible to conveniently increase the compression because of starting difficulties, so that the efficiency can not be improved as conveniently as in other types of engines.

(20) In most localities it is unlikely that alcohol power will be cheaper or as cheap as gasolene power for some time to come.

The Independent Telephone Association of Texas and Louisiana.

On February 21 and 22 the third annual convention of the Independent Telephone Association of Texas and Louisiana was held at Fort Worth, Texas. Mayor Harris welcomed the delegates, the response being delivered by Sidney Samuels, of Fort Worth.

The following officers were elected: J. B. Earle, Waco, president; E. M. Chamberlain, Greenville, first vice-president; C. W. Roberts, Abilene, second vice-president; C. W. Emmer, Beaumont, third vice-president; C. A. Shock, Sherman, secretary-treasurer. Executive committee: J. B. Earle, E. W. Johnson, Corsicana; J. C. Casler, Fort Worth; H. L. Moseley, Weatherford, and T. A. Gould, Ennis.

Industrial Education at the Altoona (Pa.) High School.

Through the initiative of the Pennsylvania Railroad Company a new development in industrial education is being tried out in the Altoona High School, Altoona, Pa. The industrial department of the school has received as a gift from the Pennsylvania equipment that places it on a par with the foremost technical schools. A four-year course is planned, which will afford a fine opportunity for technical training in the high school. The railroad expects to secure from the school candidates for its shops, who will enter them on a footing between that of the regular and special apprentices.

Office Lighting.

At a meeting of the New York section of the Illuminating Engineering Society, held March 8, the following papers were presented, all dealing with office lighting:

"The Lighting of the Offices of the Consolidated Gas Company, New York," by William J. Clark. This describes two rooms lighted by Welsbach mantles.

"Lighting of an Office Building," by Charles M. Cohn, describing the use of Welsbach mantles by the Consolidated Gas Company, of Baltimore, in its main offices.

"The Lighting of Office Spaces," by S. B. Burroughs, which describes a number of installations in Brooklyn, N. Y., lighted electrically.

"Comparison of Methods of Office Illumination," by Edward A. Norman, of which the following is an abstract:

The object of this paper is threefold:

First—To show results obtained by three different methods of office illumination.

Second—To compare the relative efficiencies of the different methods.

Third—To present results secured by arc lamps of the concentric diffuser type in a drafting room.

The two places selected for these tests were the Harlem District office of the New York Edison Company, illuminated by means of cove lighting and Holophane clusters, and the drafting room at the general office of the same company, at 55 Duane street, lighted by diffuser arcs.

The Harlem office is eighty-eight feet long, twenty-three feet wide and from twenty-three to twenty-eight feet high. A cove of special type is placed four feet nine inches below the level of the ceiling, on the side walls, and contains 280 sixteen-candle-power clear lamps, 140 on each side. The lamps are placed with axis horizontal.

Six Holophane clusters of a special type, two of which were equipped with 100-watt Gem lamps and four with standard sixteen-candle-power lamps, were installed, not so much with the idea of increasing the illumination as to give direction to the light.

The comparative tests were confined to the rear of the office on the mezzanine floor, and in a horizontal plane thirty inches above the floor.

In order to make a comparison of the cove lighting with one of the most efficient forms of incandescent lighting known, two rows of incandescent lamps, forty-two in each row, were strung temporarily along the ceiling, tip downward, equipped with Holophane concentrating reflectors, number 26-31.

From the foregoing figures the following deductions may be derived for the rear portion of the office:

Area, 1,221 Sqare feet. Volume, 28,388 Cubic Feet.	Cove.	Ceiling.	Clusters.
Watts per square foot	7.47	3.41	1.96
Watts per cubic foot	0.321	0.147	0.0842
Candle-power per square foot	2.41	1.1	0.71
Candle-power per cubic foot	0.104	0.0473	0.0304
Average foot-candles per watt	0.00042	0.00131	0.00091
Average lux per watt	0.0045	0.0141	0.0098

On the basis of these figures, therefore, figuring the ceiling lighting as 100 per cent, the cove lighting would have an efficiency of about thirty-two per cent and the cluster lighting an efficiency of about sixty-nine per cent.

The following results are quoted from the report of the test:

It is obvious that in this installation about sixty-eight per cent is sacrificed for certain effects.

While diffused lighting by the cove method is very attractive and while undoubtedly it possesses the virtue of not offending the eye by a high intrinsic brilliancy at any one point, it is nevertheless trying to a certain extent, due, possibly, to the fact that no matter where the eye rests the same uniform illumination prevails. For instance, when one looks up from a book or paper it is impossible to rest the eye by gazing at any dark portion of the room, due, possibly, to the inability of the eye to focus properly, as distances are very deceptive. It was noticed that the walls were relatively brilliant under the diffused lighting as compared to the effect produced by the ceiling lighting, due to the fact that the office is narrow. As, however, this class of lighting is only applicable to small or narrow rooms, this might be said to hold good in most installations of the same character. The absence of shadows is also very noticeable. The chief objection to direct lighting, although well diffused, is due to the fact that the glare of the lamp is offensive to the eye. Much higher illumination is also necessary, as the iris of the eye contracts under the glare of the direct light, consequently the general illumination must be increased.

There are advantages and disadvantages in both systems. Several remedies suggest themselves:

I. To use what might be called direct indirect lighting; that is, to place the lamps in the ceiling in bays behind ground glass, so that the light is well

diffused, although the source is not concealed.

II. To use deep reflectors where the light itself is not visible. Where the ceiling is high and the lamps are out of the line of vision it is possible to use a more shallow reflector.

III. In my opinion, for incandescent lighting, a combination of the direct and indirect methods forms an ideal condition. There one has the advantages of both, while the combination of the two forms would to a great extent remove the objections that hold when each is used singly. Possibly the use of lower candlepower lamps in the cove, leaving the major part of the illumination to more direct methods, would produce not only a pleasing effect, but would tend to increase the efficiency of the installation. The diffused lighting would have a softening influence upon the glare of the direct lighting. During the day illuminants of high intrinsic brilliancy are not objectionable to the eye. To a certain extent this same result may be obtained by means of diffused lighting.

The drafting room at the Duane street office is twenty-four feet five inches wide, varying from fifty-two feet four inches to seventy-one feet long, thirteen feet six inches high. The room is illuminated by five and three-quarters amperes General Electric multiple-enclosed arc lamps, fitted with concentric diffusers with inverted cone alabaster globes, and placed eleven feet above the floor.

The intensity of illumination was measured on a horizontal plane forty-five and one-half inches above the floor. The following are the average results:

1,519 Square Feet.
20,506 Cubic Feet.

Watts per square foot	8.01
Watts per cubic foot	0.593
Average foot-candles per watt	0.00111
Average lux per watt	0.0119

The diffusion is very good, and notwithstanding the fairly low ceiling and the high illumination, the light is not at all objectionable. A personal canvass among the men working under these lights confirms this opinion.

Meeting of the Armour Institute Branch of the American Institute of Electrical Engineers.

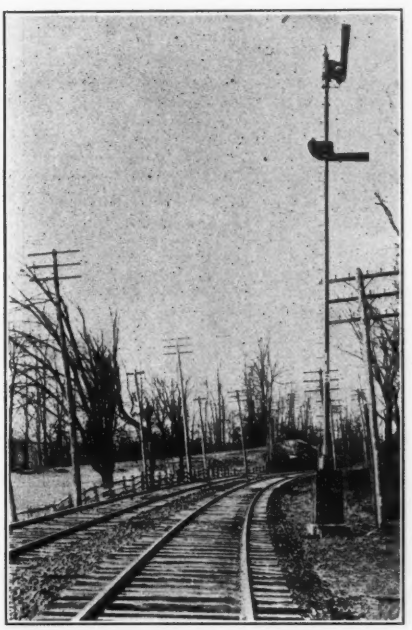
The meeting of the Armour Institute Branch of the American Institute of Electrical Engineers on March 8, at which Charles Jones, chief engineer of the Aurora, Elgin & Chicago Railway, was the speaker, proved to be one of exceptional interest. Mr. Jones held the attention of the audience for two hours on the subject, "Some Experiences in Electric Railway Building," in which he gave detailed advice as to the qualifications of the successful engineer.

A New Signal System on the Pennsylvania Railroad.

A new system of signals is being tried on the Pennsylvania railroad, and the results of its operation are of special interest owing to the fact that this new type will be used in the new Washington terminal. The system was devised by a committee appointed by the railroad to investigate existing methods of signal operation and to recommend a system which could be adopted over all of their lines.

The principles which govern the new arrangement are as follows:

(1) Two arms and two lights will be displayed on every high signal. A small arm with a lower power light will, at times, be placed further down on the post or on a separate low post, but it will be so far away from the two main signals and of so much smaller size and less powerful light, that it will in no way interfere with the two-arm and light principle.



STOP, WAIT TIME AND PROCEED SIGNALS ON POST, PENNSYLVANIA RAILROAD.

(2) Day indications are given by three positions of the arm in the upper right-hand quadrant, and at night each position is indicated by a different colored light.

(3) Class A—"Stop and stay" signals which authorize or restrict train movements, and at which a train, if it is stopped, must stay until the signal is changed allowing it to proceed. This class includes interlocking, train order, controlled manual, manual controlled and telegraph block signals. They may be distinguished by the fact that the lights are vertically over one another and the arms appear the same length.

Class B—"Stop, wait time and proceed" signals which authorize or restrict train movements and past which a train, if it is stopped, may proceed after waiting time, even though the signal has not changed and still indicates stop.

This class includes automatic signals (and incidentally distant signals when the latter are used as independent indications). They may be distinguished by the fact that the lower arm and light are not distinctly under the upper arm and light, but located toward the left, so that the lower arm appears about two feet shorter than the upper one and the lower light shows on the left-hand side of the post, while the upper one shows on the right-hand side. This staggered relation of the two signals is very noticeable both in daytime and at night.

Class C—Signals which give information only and do not authorize or restrict train movements: switch indicators, both home and distant; flag station, water tank and stop and slow signals, indicated by horizontal lights and special designs for day indicators. These signals are all low and do not interfere with the two-signal principle used on the high poles.

(4) Signals designate the speed of the trains rather than the routes, at points where interlocking systems are used.

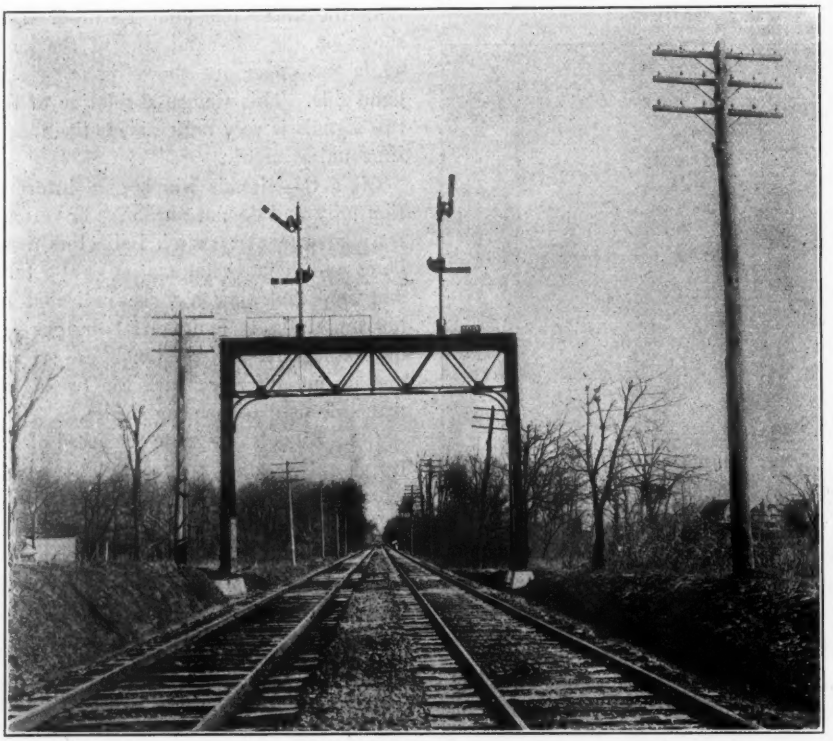
The top arm governs the high speed track, provided no crossover movement is included in the route. It indicates proceed at highest speed permissible, modified, of course, by curves or any arbitrary order placed upon the speed.

The second arm governs medium speed movements, and refers to a divergence from the high-speed routes, such as an easy crossover upon which a speed of forty or fifty miles an hour is proper.

The third arm governs low speed movements; over short crossovers, against traffic, into sidings, etc. This arm is shorter than the other two, has a short range light and is placed much lower down the post than the two main signals.

The two interlocking plants of this installation are mechanical, but all signals are electropneumatic. Compressed air at ninety pounds per square inch and electricity at 500 volts are furnished from a centrally located plant. The air is transmitted through a two and one-half-inch main and the electricity, by a No. 6 B. & S. gauge copper wire. Electricity for operating the track circuits and signals is taken from storage batteries located at

various signals. The batteries are charged in series from the 500-volt supply, eight hours at a time, four nights a week. The batteries are type 5-E "Chloride" accumulators, each signal pole being supplied with two cells. One cell is used to operate the sixteen-ohm signal cylinder magnets and also to feed the track circuit in the rear through a one-ohm resistance in connection with the rails. The other cell is in circuit ready for charging. The system of circuits is known as the "polarized wireless," the only wires used being those for the charging line, approach indicators, locks for interlockings and indication locks of the signals.



STOP, WAIT TIME AND PROCEED SIGNALS ON BRIDGE POSTS, PENNSYLVANIA RAILROAD.

The high signals are iron, inside connected, and provided at their bases with a suitable box for holding the storage batteries, cut-out switches, etc.

The signal cylinders are tandem and the arms are pulled "clear" by a three-sixteenths-inch rod instead of being pushed "clear" by a three-quarters-inch pipe or a one-inch rod. This new construction saves considerable power. The relays are five-ohm universal, neutral polar and the pole changers are pneumatic. It has developed that an ordinary mechanical pole changer would probably be as well suited to the work.

All switches are equipped with rotary circuit controllers which shunt the track through two No. 6 B. & S. wires when switches are open. All boot-leg wires are No. 6 B. & S. plugged through web of rail with channel pins and running direct to battery, relay or pole changer without splices.

The installation has been in service about two months and its operation has been highly satisfactory. During the rush hours in the morning there are ten trains east in two hours and eight minutes, or a train every thirteen minutes, while two freights are working their way west with work to do on the eastbound track at various stations. In the evening, when the commuter travel is westbound, there are nine trains in less than two hours, or a train every thirteen minutes, with generally one freight west and two east with work to do. Under these conditions the operation of signals is very frequent and the requirements for their proper operation to prevent delay and insure safety are very exacting. There are forty signals in service, equal to eighty home and distant. During December there were three failures in operation—one due to broken wire, one due to weak battery and one cause unknown. The percentage of failures on the home and distant basis is, therefore, .038 per cent.

It is probable that if the system goes into general use the colors of lights will be changed as recommended by the committee.

The indication "clear" will be given by green instead of white, and the indication "caution" will be given by yellow instead of green. This change will do away with the use of a white light and is an important improvement, for the breakage of a red or green lens can now be made to give the indication "clear," while if the new arrangement of colors is adopted a broken lens gives a white light, which does not signify anything except that the signal is improperly displayed.

A Committee to Prepare Standard Specifications for Incandescent Lamps.

The Association of United States Government Electrical Engineers and a number of representatives of the leading incandescent lamp manufacturers of the United States held an unofficial meeting on February 25, 26 and 27, at Washington, D. C. A set of standard specifications covering incandescent lamps used by the United States government was discussed, the specifications as prepared being practically adopted, with the exception of a few minor points. These will be given further consideration by a committee, the make-up of which is about as follows: Dr. E. P. Hyde, Bureau of Standards; B. F. Fisher, electrical engineer, quartermaster's office; J. E. Woodwell, electrical engineer, treasury department; W. Y. Avery, bureau of equipment, navy department; P. L. Dougherty, electrical engineer, treasury department; W. C. Allen, electrical engineer, District of Columbia; S. E. Doane, National Electric Lamp Association; Jonathan Camp, Franklin Electric Manufacturing Company; F. W. Willcox, General Electric Company; Walter Cary, Sawyer-Man Electric Company; Edward Campbell, Germania Electric Lamp Company; R. W. Morgan, Anchor Lamp Company, and Preston S. Millar, Electrical Testing Laboratories, New York city.

Copper, including under this term the ore which is brought in for smelting and the pig copper which is brought in for refining, amounted in the seven months which ended with January, 1907, to $23,500,000, against $17,750,000 in the corresponding months of last year.

Electric Locomotives for Heavy Service.

Some Interesting Features of Recent American-Built Machines.

THE accompanying illustrations will give some idea of the new electric locomotive recently built by the General Electric Company and the American Locomotive Company for heavy switching and freight service.

Fig. 1 shows the locomotive built for the Kansas City & Westport Belt Railway.

The locomotive is rated as a 404-E-100-four-GE-55-H, according to the system of nomenclature recently adopted by the manufacturers for rating electric locomotives. This system of rating is a development of the Whyte system widely adopted for rating of steam locomotives, and expresses in concise form that the locomotive is a swivel truck type of electric locomotive, weighing 80,000 pounds and equipped with four-GE-55-H motors.

The GE-55-H is a slow speed motor developed particularly for the heavy requirements of locomotive service. At the slipping point of the wheels of the locomotive the motors will develop a total tractive effort of 25,000 pounds, and at their one-hour rating will develop a tractive effort of 16,800 pounds, or will be capable of hauling a 275-ton trailing load on a two per cent grade at a speed of approximately eight miles per hour. With the same load upon a straight and level track it will attain a maximum speed of approximately twelve miles per hour.

The motors are carried upon a truck of the well-known equalized type with equalizers, spiral truck springs and double-elliptic bolster springs, but the construction of the truck throughout is particularly heavy and has been designed with a view to the heavy service which will be required of it in locomotive switching work. The wheels of the truck are thirty-six inches in diameter with fused steel tires, the wheel base being six feet six inches and journals five and one-half inches by ten inches.

The platform is built up of a framing consisting of four ten-inch channels running the length of the locomotive and riveted to end frames and bolster. The end frames are iron castings with lugs for riveting to the centre and side sills and to the draw-bar castings. Over the centre pins these sills are trussed together with heavy braces stiffened by castings and forming a built-up body bolster. The floor consists of solid sheets of three-eighths-inch plate riveted to the longitudinal sills and serving as a stiffening member for the frame.

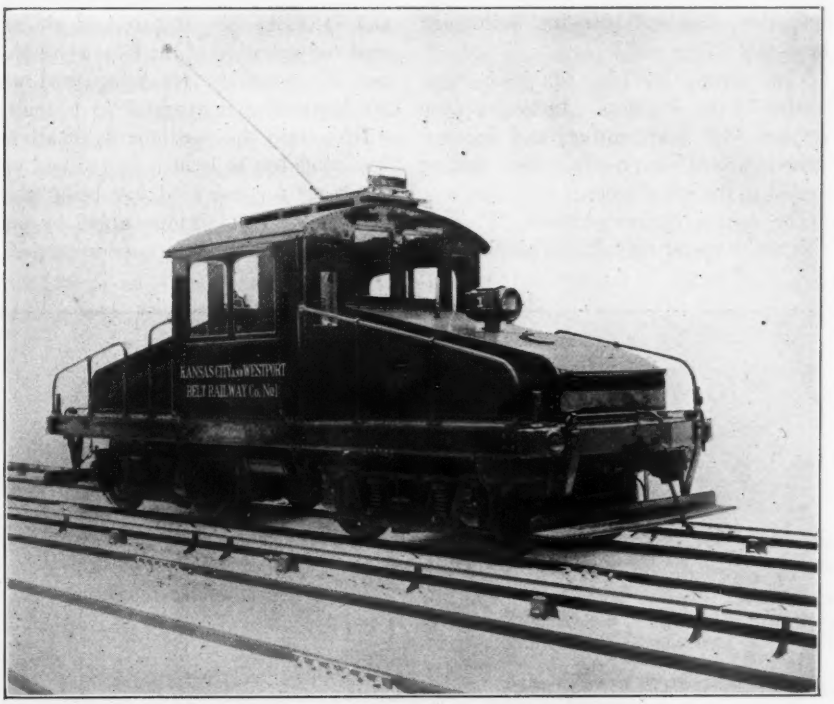


FIG. 1.—ELECTRIC LOCOMOTIVE BUILT FOR THE KANSAS CITY & WESTPORT BELT RAILWAY.

At each end of the locomotive there is a broad switchman's step about twelve inches in width and extending the whole width of the locomotive. This step is carried from the end frames by heavy braces extending from the inside and outside of the end frame casting and riveted together in such a manner as to form a step sufficiently rigid to carry any weight which may be ordinarily imposed upon it.

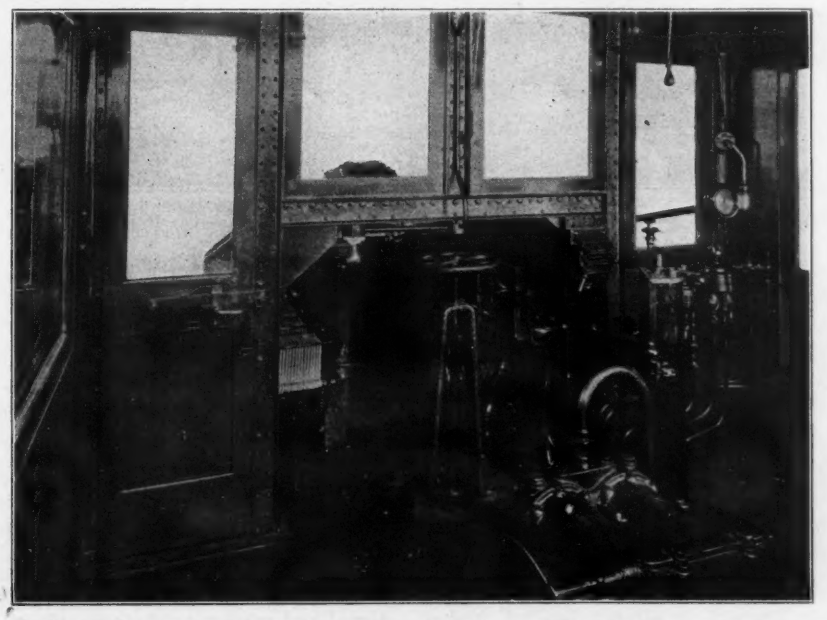


FIG. 2.—VIEW IN CAB OF KANSAS CITY & WESTPORT BELT RAILWAY ELECTRIC LOCOMOTIVE.

This switchman's step is a great improvement over the pilot very often used upon small locomotives of this type, in that it offers a greater security and convenience for the switchman or brakeman in uncoupling cars, and leaves the locomotive truck more accessible for inspection and repairs. The uncoupling rod serves as a convenient hand-rail for the switchman upon this step.

The locomotive is equipped with Master Car Builders' vertical plane couplers with yoke, springs and follower plates carried in a draw-bar casting riveted to the end frames.

The cab is the well-known "A" type with main operating cab and sloping end cabs, an arrangement of which the advantages are generally appreciated. In addition it will be noted from the illustrations that there are ample windows on every side of the operating cab. Four windows are placed in the front and rear ends of the cab, and particularly wide double windows on the sides, giving the engineer a practically unobstructed view in every direction from his operating position.

The operating equipment of the locomotive consists of electric control, brakes, and sanders, the operating levers for which are placed conveniently near the engineer's seat at the operating windows. The master controller for the electric control is located at the engineer's left hand, while contactors, and rheostats are placed in the end cabs. Air for operation of brakes, whistle and sanders is furnished by a CP-23 compresser situated in the middle of the cab. The locomotive is equipped with combined straight and automatic air; the straight air being used for operation of the locomotive alone, and the automatic air being used when the locomotive is operated in connection with a train equipped for automatic air. The sand box is located in the end cabs, the cover for the sand box being shown in Fig. 2. Sand is discharged by pneumatic sanders through nozzles carried on trucks in front of the driving wheels. These nozzles are also apparent in the illustrations.

The locomotive is complete in all minor details necessary for operation. All wiring is in conduit. Lamps for illumination of the cab, together with portable lamp and handle on extension cord, are furnished in convenient locations. Small two candle-power gauge lamps are furnished in front of the air-gauges, with shields for protecting the engineer's eyes. Signal and marker brackets are placed in the end frames. A tool chest is furnished with necessary wrenches, hammers, cold chisels, automatic tools, crowbar, oil cans and a complete set of signal flags, red, white and green.

Fig. 3 shows one of two locomotives recently built by the same companies for the Illinois Traction Syndicate. This locomotive is also a swivel truck switching type weighing forty tons on drivers, and equipped with four-GE-55-H motors.

The cab is the well-known switching locomotive cab of the general type developed some years ago by the General Electric Company, having a main operating cab, and sloping end cabs; the operating cab having a floor space of eight feet by nine feet six inches, stands in the centre of the locomotive and contains an air-compressor, together with engineer's seat at the operating windows, control mechanism, master controllers, brake valves and sander apparatus.

The end cabs are of the most recent type, covering a floor space of nine feet six inches by five feet six inches each and leaving a twenty-four-inch side platform on either side running from the operating cab to the end of the locomotive. The doors from the operating cab open at diagonally opposite corners on this side platform, thereby giving easy access from the locomotive cab to the end of the locomotive for coupling purposes; while on the operating side it gives the engineer an unobstructed view of the track in front

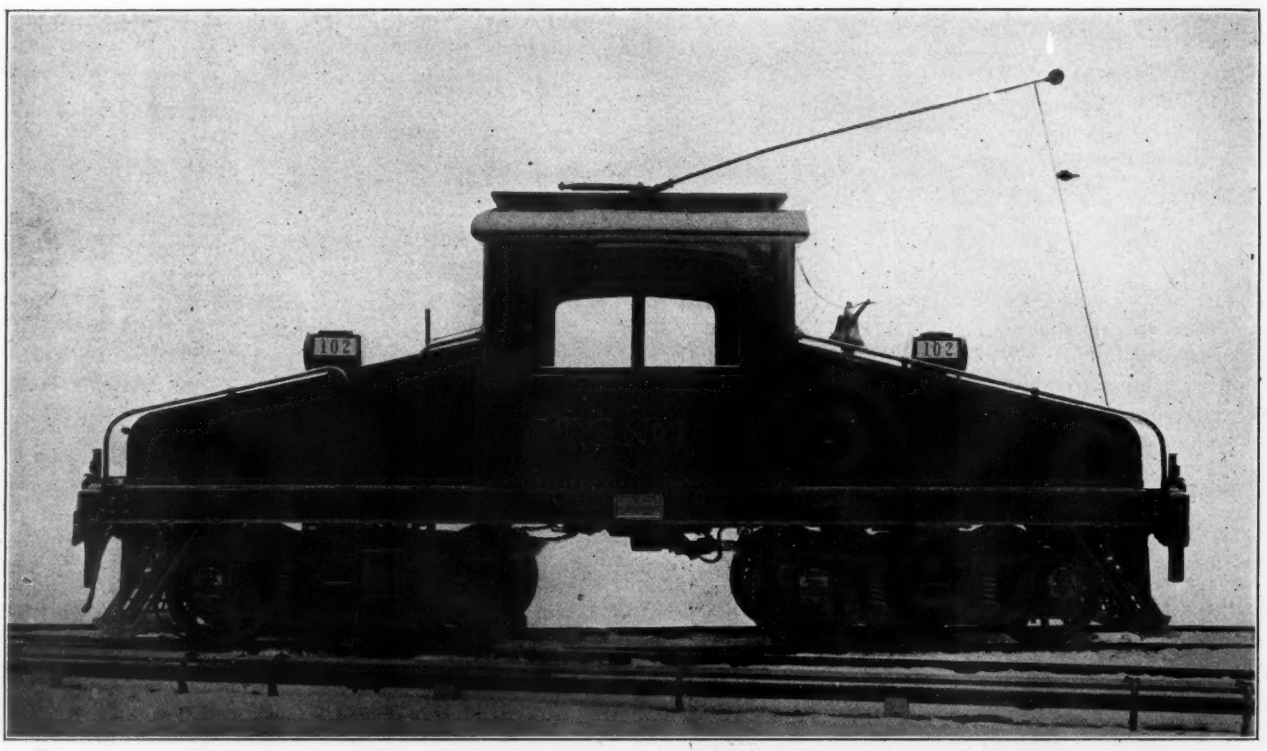


FIG. 3.—ONE OF THE TWO ELECTRIC LOCOMOTIVES BUILT FOR THE ILLINOIS TRACTION SYNDICATE.

of him, or of the train which he may be handling, to the rear, and of the brakeman or switchman at the couplers.

The cab framing is built of two-inch by two-inch and three-inch by three-inch angles, with sides and roof of No. 8, or one-eighth inch sheet steel. The end cabs are bolted to the floor and main cabs through gaskets, or shielding angles, to protect against rain wash.

The platform is built up of a framing consisting of four to ten-inch channels running the length of the locomotive and riveted to the end frames and bolster. The end frames are iron castings with push pole sockets cast near the outer ends, and with lugs for riveting to centre and side sills and the draw-bar castings. Over the centre pins the sills are trussed together with heavy braces stiffened by castings. The floor consists of solid sheets of three-eighths-inch plate riveted to the longitudinal sills. The Master Car Builders' vertical plane coupler is carried in a draw-bar casting bolted to the end frame and centre sills.

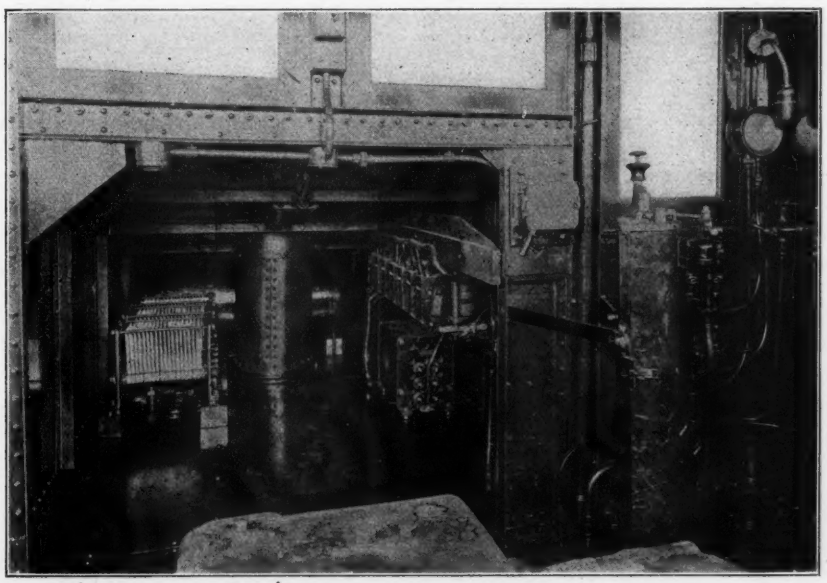


FIG. 4.—CAB END OF THE ILLINOIS TRACTION SYNDICATE ELECTRIC LOCOMOTIVE.

On each end of the platform is carried a heavy pilot built of one-inch round bars riveted to a one-half-inch bottom plate below and the four by four angle above. This angle in turn is bolted to the end frame of the locomotive with space blocks which permit adjustment in height of the pilot and the whole is braced with two centre braces and two side braces extending from the pilot bottom plate to the centre and side sills of the platform. The pilot steps on the pilot and stirrups on the end frames give easy access to the side platforms of the locomotive at each end.

The truck is of the Master Car Builders' equalized type with plate bolster. The wheel base is six feet six inches, the wheels thirty-six inches diameter with fused steel tires and the journals are five and one-half inches by ten inches, the construction being particularly heavy in order to meet the demands of locomotive service. The weight of the truck is carried upon equalizers, each of which is made of two five and one-half-inch by one and one-half-inch bars held apart by suitable distance pieces and carrying the truck frame on spiral springs. The top frame is a two-inch by three and one-half-inch rolled bar, and end frames of the same section are bolted to it. The truck transoms are built up of thirteen-inch channels riveted to one-half-inch by eighteen-inch gusset plates bolted to the truck frame. The plate bolster carrying the centre pin and side bearings is built up on nine-inch channels and plates riveted together. The whole truck construction, as remarked above, is peculiarly heavy and is designed particularly for the type of service to which it will be subjected.

The motor equipment consists of four GE-55-H motors, a type designed especially for the slow speeds and heavy tractive effort required in locomotive service. At the rated load of the motors the locomotive will give a tractive effort at the rail head of 16,800 pounds, and at the slipping point of the wheels will develop 20,000 pounds tractive effort with a load on the motors slightly in excess of their rated load.

Fig. 4 is a view of the interior of the locomotive cab showing the apparatus at one of the engineer's operating positions, and a view of the interior of the end cab. In front of the engineer's seat stands a master controller operating the contactors used for type M single-unit control. Brake apparatus for both straight and automatic air, and pneumatic sanding valves are also within easy reach. In the end cab are contained the contactors and rheostats of the control system. The air reservoir and pneumatic sanders arranged for sifting sand through nozzles are carried upon the trucks directly in front of the forward wheels of the locomotive. In the centre of the main operating cab stands a CP-23 air-compressor operated from the 500-volt circuit, having a piston displacement of fifty cubic feet per minute.

Some of the particular dimensions of the locomotive are: length over all, 31 feet 1 inch; height over cab, 11 feet 9 inches; width over all, 9 feet 6 inches; rigid wheel base, 6 feet 6 inches; weight of electrical equipment, 27,500 pounds; weight without electrical equipment, 52,500 pounds.

The Michigan Independent Telephone Association.

The tenth annual convention of the Michigan Independent Telephone Association was held at Coldwater, Mich., on March 8 and 9. Incomplete reports of the companies of the state indicate 100,000 independent telephones in service in Michigan.

Among the speakers were J. B. Hoge, Cleveland, Ohio, president of the International Independent Telephone Association, and Frank L. Beam, Mount Vernon, Ohio, president of the Ohio Independent Telephone Association.

The following officers were elected: president, E. B. Fisher, Grand Rapids; secretary, W. S. Vivian, Grand Rapids; treasurer, A. C. Himebough, Burr Oak.

Five delegates at large to the international telephone convention, which will be held in June, were elected as follows: J. B. Ware, Grand Rapids; W. B. Woodbury, Detroit; A. C. Himebough, Burr Oak; W. J. Melchers, Alma; C. E. Tarte, Grand Rapids.

A legislative committee was appointed, consisting of W. B. Woodbury, R. B. McPherson, R. D. Graham, Thomas Bromley and W. J. Melchers.

A FEW COMMENTS ABOUT ELECTRIC LOCOMOTIVES AND SOME OTHER THINGS.[1]

BY FRANK J. SPRAGUE.

A recent grave disaster has been made the pretext for various comments and strictures, a few pertinent, the majority senseless and many knowingly untrue, concerning electric traction in general and more specifically the system and locomotives adopted on a great trunk line division.

What are the facts?

Under date of May 5, 1903, the New York Central Electric Traction Commission, of which Vice-President W. J. Wilgus was chairman, and of which I had the honor to be a member, issued preliminary specifications for electric locomotives to ten domestic and foreign manufacturers.

These specifications were accompanied by such facts, run sheets and other data as would permit bidders to intelligently formulate their own conclusions. While specific as to certain requirements, ample latitude for the exercise of individual judgment was given all manufacturers, as is indicated by the following brief extracts:

"While certain essentials will necessarily govern the final selection of motors, it is the intention that all reasonable latitude will be extended to the manufacturers for elaborating any special plans which may be worthy of incorporation in the general plan. It is expected that the bidder will confer and work in conjunction with designers and manufacturers of steam locomotives of recognized standing, in designing the mechanical portion of the locomotive.

"Should any bidder deem any requirement prohibitive in the free exercise of his best skill in the production of locomotives to fulfill the desired conditions, the Electric Traction Commission will appreciate any suggestions he may care to submit.

"Both alternating and direct-current motors will be considered, but in this connection it should be borne in mind that since all suburban service will be performed by trains having distributed motors, multiple-unit control will be used for all equipment."

The locomotives were to handle a trailing load of 400 tons at schedule speeds, and to operate under the generally existing steam railroad track conditions, including curves with a minimum radius of 230 feet. A maximum speed of seventy-five miles was required,—of course on straight, sound track and with light loads.

[1] Abstract of an address delivered to the Railroad Club, New York City, March 15.

Five months were allowed bidders, and proposals covering a large variety of locomotives were received from one foreign and two American companies, the General Electric and the Westinghouse. The former included one bid for single-phase alternating-current motors of the repulsion type, which was very properly not seriously considered, but really recommended a new direct-current gearless type. The latter submitted no bid for alternating-current motors, a description only of gearless locomotives, and also recommended direct-current locomotives, but of a geared type.

The existing technical development, the high duty required and many specific local conditions, many of which were arbitrary, and all of which are still practically unchanged, finally determined the adoption, by unanimous vote, of direct-current apparatus, a decision generally endorsed by the technical press, and the selection of locomotives narrowed itself down to the 2-8-2 gearless motor type now in use on the New York Central, and an 0-8-0 type equipped with geared motors.

In view of certain recent comments, some detail comparison of these two locomotives is interesting. The locomotive adopted has a rigid wheel base of thirteen feet, with four pairs of drivers on which is carried about seventy per cent of the total weight and at each end there are pivoted, spring-centered, two-wheel guiding pony trucks which extend the flexible wheel base to twenty-seven feet. The drivers are forty-four inches in diameter, and the armatures are carried upon the axles, the weight of each axle unit not carried by springs being 12,745 pounds. There are no gears, and no armature or field bearings, but the bipolar field magnets are carried by, and form an integral part of the locomotive framing, the magnetic circuit being completed through the upper part of the side frame and a special bar carried above the motors, and hence are spring supported. The axles have a limited lateral movement, and the field magnets move independently of them. The centre of gravity is about forty-four inches above the rail, higher in fact than any electric locomotive of like diameter of drivers in this country. The resistance of the spring and friction plates against deflection from the central position is such that when the guiding trucks are deflected on a curve they very largely, with proper super-elevation and easing of gauge, relieve the outer rail from lateral main driver pressure under normal conditions of service.

The other locomotive was of a type similar in many respects to the half unit common to single-phase alternating current geared motor propositions, except that there were four instead of three pairs of drivers. The rigid wheel base was fifteen feet, six inches, centre to centre, and the drivers fifty-four inches in diameter, somewhat increasing the lateral friction stress across the tops of the rails when on curves. The geared motors were independent of the locomotive frame, and carried entirely upon the axles, the two pairs being oppositely extended, making the centre distance between the outer pairs twenty feet and four inches, that is, nearly four feet longer than the rigid wheel base. The entire weight of the motors was not only supported by the axles, but there was undue pressure in their centres, and a large proportion was carried as dead weight. The armature revolutions for the same train speed were about forty-five per cent higher, and hence the gyroscopic effect much greater. There being no pony trucks whatever to help guide this locomotive around the curve, its tendency to go off on a tangent was particularly obvious, and the strain on any possible condition of track much more serious.

So much for the preliminaries.

In an enterprise of such magnitude as that undertaken on the New York Central road, the members of the traction commission, whether officers of the road or outside engineers, did not believe themselves justified in proceeding with the final equipment except step by step, exercising supreme caution, and testing every possible development. Therefore, the machine as designed by the General Electric and the American Locomotive companies having been selected, and its service requirements somewhat increased, in the latter part of November, 1903, a contract was entered into for the completion and test of one locomotive under rigid conditions, and for the completion of thirty machines, provided a test, to be made on a special experimental track some six miles long near Hoffman, N. Y., proved satisfactory. Nearly a year was given to develop this locomotive; the first machine was tested October 27, 1904, and a formal run was made on the 12th of November. This first locomotive, despite passing through a fire which necessitated partial rebuilding, and although subject to some of the early diseases incident to all new apparatus, has actually acquitted itself in a manner unsurpassed by any like apparatus ever built. During a period of two years, on an inferior track laid with only

eighty-pound rails in gravel ballast, it has been run a total of 67,000 miles, under all sorts of conditions and loads, with operators of varied experience, and at speeds as high as eighty-three miles an hour on curves, and has never yet left the track. Moreover, these trials were public, and the detail description of the locomotive was published in technical journals the world over. It has remained for the present to utter post-mortem criticisms.

After four years of preparation, electric service was finally installed on a portion of the so-called electric zone, the delay on the balance being largely due to suburban conditions over which neither the railroad company nor the traction commission had any control. The service was first initiated with the suburban multiple-unit steel motor-car trains, and soon afterward electric locomotives were used, first for switching in the yards, and then for handling regular trains hauled by steam beyond the territory of electric operation.

On February 16 a most lamentable disaster startled the community—the wreck of an electric train ten miles from the Central station, on a three-degree curve under a highway crossing known as the Woodlawn bridge, with the result that over a score of lives were lost.

The accident was caused by a derailment in which four passenger cars were hurled from the track, ripping up both the traffic rails and the protected third rail, landing finally on their sides on the adjacent tracks, and crushing the unfortunate victims who had been thrown through the windows between the sides of the cars and the ties.

A White Plains express, which ordinarily would be made up of five cars weighing with the full complement of passengers about 160 tons, and a single electric locomotive weighing about ninety-four tons, which on this particular schedule is intended to handle a total train load of 350 tons, was sent out with a second locomotive. Because of some missing collecting shoes, the bus-lines of these locomotives were coupled up, and in addition, but not necessarily, both locomotives were operated. The train left Mott Haven, four miles from the scene of the disaster, from six to seven minutes late, running first on a down grade and then on an up one, passed through two curves and ran by one of the substations, still on an ascending grade. According to the testimony of the motorman, who was accompanied by an inspector and the assistant division superintendent, current was cut off from the full multiple portion of the controller about 2,000 feet from the bridge, the train coasting on an up-grade of from thirty-six to twenty-five feet to the mile. It safely entered the spiral approach of the curve, at about which time the controller was thrown into the series-multiple position, and just under the bridge, when full in the circle of the curve, and at the apex of the grade, where the original calculated schedule called for a speed of fifty-one miles, only six miles greater than the "equilibrium speed," there occurred the beginning of the accident, whose local effects were indicated by a broken rail, sheared tie spikes, and tie cutting by derailed wheels, and then the throwing of four cars completely over on their sides on to the adjoining tracks.

The two locomotives and the leading car, although running on a down grade, were stopped 1,500 feet from the bridge on the tangent, the distance between the rear of the smoking car and the overturned ones being about 600 feet. The wheels of the leading locomotive were all on the track except those of the rear pony, from which a tire-retaining ring, subsequently found whole, was missing, the bolts holding it in place having been sheared off. The leading pony of the second locomotive and all the drivers were off the track, but closely hugging the rails.

This serious disaster on the first great trunk line electric railway installation instantly became the subject of grave exaggeration, and many reprehensible and as yet unexplained individual criticisms. The changes were rung on the toothsome morsels of the penny-a-liner, the "deadly third rail," the "holocaust" of fire and the "electrocution" of helpless passengers.

Well, there was power enough concentrated at the head of this ill-fated train to account for almost anything if not intelligently handled, and yet the same wreck might have occurred, whatever the power used.

Of course the "deadly third rail," or the use of the direct instead of the alternating-current had nothing whatever to do with this disaster. There were no electrocutions, and what fire there was, whatever the cause, occurred directly over the broken connection of a Pintsch gas tank, and was quickly put out. There is not the remotest evidence that the third rail caused even this slight fire, but there is plenty of evidence that this particular third rail was instantly automatically cut out of service, and that it was impossible to restore it until the wreck was cleared.

Any system of conductors can be temporarily put out of service. A third rail, whether of the top or under-contact type, will be knocked down, short-circuited and put out of action; the top contact rail can be most quickly restored, but by using double-acting shoes the other can likewise very quickly be put into service, and the work completed later. The manner in which the cars on another New York Central wreck were thrown, the demolition of a switch tower at Tivoli, the destruction of a foot bridge by rearing equipment on the New Haven road, as well as scores of other accidents, all show equally that it is quite within regrettable possibilities that steel columns supporting the overhead bridges which carry the messenger cables and trolley of the alternating-current equipment can be demolished, with a resulting dropping of a bridge across all tracks, the tearing down of overhead work, and whatever incidental disasters some particular combination of circumstances may bring on.

Of course, there was a cause for this accident, and hasty first conclusions specified high speed, or defective track construction.

A light train with an excess power equipment, running at night and with the smoothness of operation characterizing the movement of these locomotives, with full potential near a substation, and behind time, could have, unconsciously if you please, been run at a speed which would have put an undue strain even on a perfectly true and well-banked curve in sound condition, and one which might prove disastrous in case of any temporary track trouble. But this has not been proven. As to the track, it was of the normal standard, but there might easily have been some temporary defect, common, even with the strictest supervision, in times of thawing and freezing.

Or there may have been a local cause initiated by the passage of a previous train, or perhaps the breaking of some part which acted as a wedge between a truck wheel and a rail. The alarming frequency of these latter causes is sufficiently indicated by the general accidents to which I have referred, and specifically by the published statement that on a three-mile section of a standard trunk line, the track walkers discovered in time to prevent an accident not less than twenty broken rails in the month of February alone.

In common with all engineers, I can only hope that the real cause of the accident will be found, but in that confusion which so often follows a great disaster, when on a congested trunk line the service is restored as quickly as possible, the necessary evidence may be missing if there was a specific local cause. If, on the other hand, the accident was because of a lack of care in maintenance of track, or errors of judgment in the scheduling, and making up and operation of trains, then that is a matter to be determined by the proper sifting of the testimony of all concerned, and such facts as may be gleaned from the attendant circumstances.

Electrical Notes from Great Britain.

(By Our British Correspondent.)

THE work of the National Physical Laboratory has already formed the subject of considerable inquiry, discussion and criticism. The government has appointed a special committee to inquire into the work performed there, with special reference to the character of the tests undertaken at Bushy and the lines on which further development of the work there should be conducted.

The reports of our great railway companies are watched with a certain amount of interest every half year by electrical men who want to know the latest attitude of the railway official toward electric traction, and also want to glean whatever information, however scanty it may be, is vouchsafed by those companies who are able to speak of the results of electrical working on sections of their systems. The North Eastern chairman reports that on the Newcastle-Tynemouth direct-current lines there were carried 4,195,339 passengers, as compared to only 3,548,206 in the corresponding half of the previous year. The receipts from fares showed a corresponding increase, while the working expenses had decreased. But, he added, so far their experience of electric working was so short that it was impossible for the most scientific person to accurately calculate the depreciation chargeable, though it was hoped that they would be able to do so in a year or two.

The London, Brighton & South Coast is losing its suburban traffic in London so heavily that it is patting itself on the back for having undertaken the electrification of its South London lines between London Bridge and Victoria. It has, like most other large railways, lost much of its short-distance traffic, owing to the competition of municipal electric tramways, but its hope is that when the electrification is completed (experimental running, it is said, may be commenced early next year), this traffic will be brought back again. Judging from what has happened in the Tyneside district, that may be expected.

The Central London tube is suffering from the effects of motor-omnibus competition. Those twenty-six heavy electric locomotives with which the line started, but which were, a little time after, superseded by reason of the vibration and permanent way troubles, have now been brought under the hammer. Two were sold by way of experiment just to see what they would fetch, but the result was a resolution to dismantle the engines and sell the material. Happily the high prices of metals have some compensations, and the advances that have taken place in copper, brass and steel since the engines were built will help a trifle to reduce the cost of the sacrifice. It is not altogether out of the question that the "Twopenny Tube" may change its system of fares from a uniform to a differential basis. But it will always retains its name—the "Twopenny Tube."

One railway chairman (at the London, Tilbury and Southend meeting) made some remarkable observations which seem to lack confirmation. One of these was: "At the present time all the companies that had adopted electric traction were very much disappointed, suffering, as they were, considerably from the results achieved as compared with the estimates . . . by those who were supposed to know." He went on to refer to the fact that the rolling stock of some of the London lines was cutting the rails to a serious extent, especially at points and crossings. He said that the district had laid down some hardened steel rails to meet the difficulty. At the metropolitan meeting Sir Charles McLaren, in referring to the increased cost of maintenance of that line, remarked that the life of the steel rail on the electric system was very much less than it was under steam. The wheels actually pared the rails away, and many portions of track had had to be relaid with rails of extraordinary hardness. The electrification, he said, had cost more than they anticipated, and if they had not electrified when they did they would have been in a far worse position to-day. They were running no fewer than 1,006 electric trains on their system every day, and they had proved that they could run electric trains on a very large scale with complete success.

The Lancashire & Yorkshire, which operates the direct-current electric lines between Liverpool, Southport and Crossens, is able to report that it is getting back a considerable amount of the traffic which had been attracted away by tramway competition, especially in the districts where the electric service of trains obtains and where rail motors have been introduced.

That very unfortunate electric line—the Liverpool Overhead Railway—finds little to be happy about. Built at a time when municipal electric tramway systems were hardly thought about, and before electrification of the Liverpool-Southport Railway was even dreamed of, it has to suffer year by year from the competition of these two rivals, and all its efforts to earn sufficient profit to pay a dividend on its ordinary stock are nowadays quite unavailing. It seems a hard, but not altogether unusual, thing that the two pioneering electric railway systems of the United Kingdom (the Liverpool Overhead and the City & South London Underground) should have had to struggle on for so lengthy a period with so paltry a return on the capital invested.

At the meeting of the British Aluminium Company, held in February, big development schemes were unfolded for meeting the rapidly increasing demand for aluminum. This company, which has the rights for the United Kingdom, is, as we have recently shown, already engaged upon constructional works for the utilization of the Loch Leven water power for the purpose of manufacture. But since this scheme was put in hand the demand for the metal has been increasing by leaps and bounds. Indeed, there is more or less of a "famine" of aluminum. It has been found desirable to develop almost at once a small amount of power (3,000 horse-power) at Loch Leven without interfering with the main scheme. It is expected that this 3,000 horse-power will be available by the autumn of this year. But so bright are the hopes for the future that steps have been taken to extend operations even far beyond what is contemplated at Loch Leven. The British suppliers have secured a big water power at Stangfjord, in Norway, which is already developed, and which it is expected will be serving in aluminum production in about three months' time. They have also purchased water power concessions at Orsières, in Switzerland. With all of these different works the British Aluminium Company will have a total of 70,000 electrical horse-power.

Under an agreement made in 1901 the Marconi International Marine Communi-

cation Company gave to Lloyds the right to use the Marconi system for maritime signaling, the Marconi company providing and installing apparatus for working the system at such signal stations as Lloyds might require and pay for. Under later arrangements the Marconi company, so Lloyds alleged, were bound to install the Marconi system at Lloyds' signal station at the North Foreland. This they actually did, but they removed it (in April, 1906) from that station and set it up at a new station not far away, thus, as Lloyds alleged, making it impossible for the Marconi company to perform their obligations. Lloyds contended that there could not be two stations at the spot and argued they were entitled to retain the one which was already established when the agreement was made. The matter has now been fought out in considerable detail in the London Chancery Court, and Justice Kekewich has declared that Marconi's are bound to provide at Lloyds' signal station at the North Foreland apparatus for operating the Marconi system there.

It is desired to have electric cars running between Leeds and Bradford. Both cities have extensive electric trolley systems in operation, but there is a difference in the gauge of track in the two places. To overcome the difficulty C. J. Spencer, the Bradford City tramway manager, and his assistant, Mr. Dawson, have introduced a new truck, with which experiments have recently been successfully conducted, for enabling cars to travel over different gauges. The wheels on the new truck are mounted on sliding sleeves, and by unlocking the gear the wheels are able at the junctions of the Leeds and Bradford systems to accommodate themselves to the change of gauge.

According to official statistics which have just been issued, the tramways of the United Kingdom for the year 1905-6 measured 2,240 route miles. The number of electric cars all told was 9,276, and of non-electric 1,614. Some 316 millions of Board of Trade units were consumed in operating the electric cars, and there were also 9,786 horses still employed in tramway work of some kind or other. The working expenditure was 64.23 per cent of the gross receipts, and the passengers carried per car-mile were 9.16.

ALBERT H. BRIDGE.

London, March 9.

The Cost of Steam and Electric Locomotive Operation.

The final arguments for the electrification of a steam railroad are reduction of operating costs and increase of earning capacity for present tracks. The former of these arguments has been discussed by G. B. Werner. There are other incidental advantages accruing from the use of electricity as motive power which are of considerable importance, although difficult to evaluate in dollars and cents. These include small wear and tear on tracks, elimination of smoke, cinders and gases, greater facility of train movement, resulting in an increased earning capacity of the line. The figures for the cost of steam locomotive operation were compiled from the annual report of a railroad which was contemplating electrifying a particular division. The division in question was a part of the main line, double-tracked, and seventy-eight miles in length. The traffic consists largely of freight trains of from 600 to 1,400 tons, the schedules for these varying from 8.7 to 9.6 miles per hour. The passenger trains average 250 tons, and make a schedule of about twenty-seven miles an hour. The ton-miles a year were over 1,500,000,000, and the average train weight was 700 tons. The last annual report shows that the cost of locomotive operation was 26.2 cents per locomotive-mile. This figure does not include fixed charges, maintenance and depreciation, roundhouse expenses, maintenance of shops and maintenance of fuel and water stations. The train schedule shows that forty-three locomotives are required for moving trains, twenty per cent are undergoing repairs or otherwise out of service and eleven per cent are required for switching service. A total of sixty locomotives is required for all services. Adding to the cost per locomotive-mile, for interest, insurance and depreciation of locomotives, for shop and roundhouse costs, the cost of steam locomotive operation per locomotive-mile was found to be 32.13 cents. The project for handling the service by means of electric locomotives contemplated an entire electrical equipment, comprising a power-house with an output of 10,500 kilowatts, a double transmission line operating at 33,000 volts, eighteen substations with an aggregate rating of 12,250 kilowatts, overhead working conductors with a normal pressure of 3,000 volts, six sixty-six-ton passenger locomotives, and twenty-two ninety-ton freight locomotives. The annual cost of operation was divided into three parts—cost of generation, cost of distribution and cost of locomotive operation. The figures for these different items include interest charges, insurance risks, taxes, depreciation, labor, maintenance, repairs, etc. The cost of generation includes also interest on buildings and sites. The cost of distribution allows for depreciation of trolley line 3.39 per cent. Operating expenses include attendance and inspection. It was found that the total cost is 39.57 cents per thousand-ton miles, or 27.69 cents per revenue train-mile, corresponding to the 32.13 cents per steam-locomotive-mile. A detailed statement shows the following: repairs to locomotives amount to 8.32 for steam and 1.67 cents for electricity; the wages for the steam locomotive, including those of the roundhouse men, are 10.37 cents, and for the electric 5.38; the cost of fuel, water and care of supply stations is 10.62 cents for steam, and the cost of the power delivered to the electric locomotive is 17.62 cents. Interest on the steam locomotives is 1.41, on the electric 9.76 cents. The depreciation of the steam locomotive is 2.12, and for the electric 1.40. The other items show little variation in favor of either system. The conclusion reached is that the revenue train-mile cost is about fifteen per cent greater than the locomotive-mile cost, and that the net saving with electricity as motive power, due to reduced operating costs, would be 7.91 cents per revenue train-mile, or 21.5 per cent. This amount is equivalent to an additional dividend of seven per cent over and above the four per cent interest charged on the capital invested. The gain due to increased earnings can not be predicted from present information. For this reason no allowance has been made for it.—*Abstracted from the Engineering Magazine (New York), March.*

Electrical Undertakings in Japan.

The Japanese Empire is a good field for manufacturers of electrical devices. According to the list of Japanese enterprises formally organized and projected since July, 1905, furnished by Consul-General H. B. Miller, of Yokohama, the new capital of companies building electric railways amounts to $55,825,000, and the investment in other electrical enterprises is $49,711,500, of which $27,375,000 is employed in developing Japanese water powers. Only $14,825,000 has gone into steam railways. In all $248,896,500 fresh capital has been contributed to Japan's industrial expansion since the Treaty of Portsmouth.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

Compensating Windings for Dynamos.

A method of winding compensating coils for dynamos, which is thought to have some advantages, has been devised by C. A. Parsons and J. H. Armstrong, of England. It is sought to overcome the difficulty of bending large conductors, placing them in slots cut in the face of the field poles without injuring the insulation. This is accomplished by building the conductor up of a large number of copper links bolted together, each link being of suitable length. These links are then insulated and placed in slots in the pole face, the arrangement being such that every armature conductor in every position is paralleled by one of these compensating conductors, the latter being arranged so that the centre of each compensating coil comes midway between two adjacent poles. The coils are connected in series with the armature, and in this way set up an opposing magnetomotive force which at all times is equal and opposite to that due to the armature.—*Abstracted from the Mechanical Engineer (London), March 2.*

Electrical Equipment of Fishguard Harbor, South Wales.

The Great Western Railway has put into service at Fishguard Harbor in South Wales, an elaborate system of electric cranes for cargo handling. There are nine cranes, each capable of lifting thirty hundredweight at a radius of thirty-five feet, of what is known as the half portable type. They have a high gantry carried on two rails, one at the ground level and one on girders which form part of the roof structure of the warehouse. The difference in level is eleven feet six inches. These cranes are operated by electric motors carried in the cab on the gantry, which traverse the crane and also hoist the loads. The hoisting is done by means of a single rope wound on a drum driven by a friction coupling. The load is lowered by its own weight, the coupling being disconnected from the motor, and it is then controlled by a band brake. This arrangement allows the load to be stopped quickly, it not being necessary to overcome the inertia of the motor and gearing. A tenth crane for handling coal has been erected, which is capable of lifting a load of twenty-one tons at a radius of thirty-five feet nine inches. The coal cars are run on to a cradle and lifted by the crane and slewed over the vessel. The cradle then tips the car and empties the load. The crane is slewed by a motor of eight horse-power. The dock is also supplied with a number of electrically driven capstans capable of giving a pull of one ton at a speed of 200 feet per minute. The latter are driven by means of twenty-two-horse-power motors through a worm gear submerged in oil.—*Abstracted from Electrical Engineering (London), February 28.*

Standard Cells.

Further investigation into the constancy of the Clark and cadmium standard cells has been made by K. E. Guthe and C. L. von Ende. A number of cells of each type were made up, some of these being transported from Washington, D. C., to Iowa City, Iowa. These cells were carefully protected during the trip from mechanical disturbances, and it has not been found that they in any way suffered. The results of this study have shown that by following the rules which have gradually been evolved for constructing Clark cells that there is no difficulty in preparing new cells which do not differ from those prepared by others, provided, of course, the work be done carefully. The same has not been found true of the cadmium cells, as these all show an initial decrease in potential. It was found that mercurous sulphate might be prepared by different observers from different sources, and yet give results agreeing with those of others, within a few hundred-thousandths of a volt. Mercury distilled in ordinary vacuum gives the same results as mercury distilled by Hulett's method. Amalgam may be prepared in the usual way and give the same results as that prepared electrolytically. In constructing cadmium cells it was found that the cloudy and clear crystals give similar results. The Clark cells of electrolytic coarse-grained mercurous sulphate have shown, immediately after construction, an electromotive force of 1.4204 volts at twenty-five degrees centigrade, within a few hundred-thousandths of a volt, and remain constant with course of time. The observers were unable to construct cadmium cells which did not show an identical decrease in electromotive force.—*Abstracted from the Physical Review (Lancaster), February.*

Modern Electrically Equipped Shipbuilding Berths.

Brief descriptions are given here of several electrically operated methods of handling materials for shipbuilding, as adapted to the needs of British shipbuilding yards. One of these is that installed at Palmer's yard, Jarrow, which consists of a system of overhead cableways upon which electrically operated trolleys run. These cableways are themselves supported by carriages held by braced supports 125 feet above the berth, which allows them to be traversed across the berth while the trolley itself runs longitudinally. All the motions of longitudinal and lateral hoisting are accomplished by means of electric motors. The cable span is 490 feet. John Brown & Company's shipyard at Clydebank is equipped with vertical derricks spaced 100 feet apart, capable of lifting a load of five tons to a height of 125 feet from the ground. The mast is a braced column 130 feet long, six feet square in the centre, tapering toward the ends. The jib is also of square section. The hoisting is accomplished by a thirty-five-horse-power electric motor, the slewing by one of ten horse-power. The Dalmuir dock of W. Beardmore is supplied with overhead traveling cranes running on a large gantry, the two sides of which are at present braced together, but may be roofed in for protection from the weather. The side braces are also provided with side-walking cranes, which travel along them, work from any point, and are capable of handling loads of five tons at a radius of thirty feet. The traveling cranes have a span of 108 feet, a total travel of 750 feet along the berth, and are capable of lifting fifteen tons to a height of 140 feet. All the power is supplied by means of electric motors. The same yard has a long electric cantilever crane for handling plates in the storage yard. This is carried on a gantry and has a total traverse of 240 feet and a clear lift of twenty-two feet above the rail.—*Abstracted from the Electrical Review (London), March 1.*

Single-Phase versus Three-Phase Power Transmission.

The justice of claiming a saving of twenty-five per cent for three-phase transmission, as compared with single-phase, taking as a basis of comparison equal voltage between the conductors, is questioned here by E. Van Loben Sels. The point is made that the limiting factor should be the insulation of the wires, as it is this which limits the capability of a system. In dry weather, leakage across dirty insulators will affect the potential of a pole with respect to the earth, to some extent; but in wet weather, which is the most unfavorable condition, the pole and cross-arms become conductors, and their potential is therefore maintained at that of the earth. Since good operation requires that the insulators be kept clean, it is fair to assume that the variation of the pole and cross-arm from zero potential may be neglected; therefore the strain on any insulator is the maximum difference of potential between any one wire and the neutral. It follows from this that the voltage on a single-phase system can be raised fifteen per cent without throwing a greater strain on the insulators than that occurring in a three-phase system. Under this condition the total current flowing through all conductors of each system would be the same, but the wires of the single-phase system would have to be placed fifteen and one-half per cent further apart, if it were desired to keep the same factor of safety on the atmospheric dielectric. This is a minor matter compared with the increase in length of pole required for a three-phase system and the additional insulators and pins. It is therefore evident that the saving of twenty-five per cent credited to the three-phase system is not affected by any inherent superiority of this method of transmission, but is only secured by increasing the strain on the insulators; and if the voltage be raised on the single-phase system until the strain imposed on the insulators is the same in both systems, then both systems require the same quantity of copper. A decision between the two systems must therefore be based upon other considerations. In the transmission of power running high into the thousands of kilowatts a saving of one-third of the insulators, pins and lightning arresters may not be worth taking into consideration, as against the advantages of the three-phase system for power purposes. The polyphase motors are self-starting and less likely to get out of step. But for the transmission of power in small quantities, particularly where the load is nearly all for lighting, one-third of the copper can be saved by transmitting single-phase current. Moreover, for lighting purposes the single-phase system has some advantages, as it is easier to balance a three-wire, single-phase system than the three sets of a three-phase, four-wire system. Furthermore, for railway purposes the single-phase system is desirable on account of the new types of motor. This motor is also suitable for other classes of work, such as driving elevators. On the other hand, where heavy machinery must be started under full load, the polyphase system is necessary. The final decision in favor of either system must therefore be based upon the local demands.—*Abstracted from the Journal of Electricity, Power and Gas (San Francisco), March 2.*

A Simple Process of Electroplating.

Occasionally it is desirable to protect metals by plating them with copper or other metal, but this can not be done conveniently because of the large size of vat which would be necessary in order to submerge the article to be coated. To overcome this difficulty R. Goldschmidt has tried the following method, and found that it gives excellent results. It consists simply in cleaning carefully the article which is to be protected, so as to remove all dirt and grease and leave a surface suitable for plating by the ordinary process. The article is then attached to the negative pole of the source of current and an ordinary paint brush, capable of containing a considerable amount of electrolyte, is attached to the positive pole. This brush is then passed over the part which is to be plated, carefully, and as the current passes through it, a smooth, adherent, strong coating of the metal may be built up to any desired thickness. The process is easily carried out, and gives results of excellent character. The author, in his experiments, used a voltage of 110, but placed a number of incandescent lamps in series with the brush, so as to limit the current to about one-tenth of an ampere. He was able to plate successfully in this way silver, gold, copper and nickel, and had no difficulty in coating different parts of the same object with different metals. Nickel was found preferable for a protective coating, because of the low voltage required in the process. Details of the solutions employed are given, cyanide solutions being used for gold and silver, and sulphate solutions for copper and nickel.—*Translated and abstracted from L'Industrie Électrique (Paris), February 25.*

Moving-Picture Exhibits and the Department of Electricity, Water and Gas in New York City.

The Department of Electricity, Water and Gas, New York city, in conjunction with the fire department and the National Board of Fire Underwriters, has been conducting a crusade against the manipulators of moving-picture machines in New York city. About a year ago the electrical bureau of the Department of Electricity, Water and Gas began a careful inspection of these devices and discovered great indifference to rendering this apparatus even a reasonably safe fire hazard. New York city, in fact, is the pioneer in the movement toward making these machines safe. In most instances, when this crusade was begun, the celluloid films were placed upon an open reel at the top of the machine and allowed to fall into a flannel bag at the bottom of the machine, without any protective devices or shields surrounding this highly inflammable material. Under the direction of the experts of the electrical bureau the machines are now being equipped with sheet metal cases encasing the reels both above and below the projection apparatus. Where the celluloid film leaves the upper case, and again where it enters the lower case, it passes between brass rollers, which would smother any flame which might be started outside of the cases. This would effectually prevent the greater portion of the film taking fire and creating an extensive conflagration.

It has been demonstrated that the operator sometimes held the film in the beam of light from the arc lamp, while making an adjustment at the arc, so long that the film took fire. In order to obviate this possibility the machines are now fitted with an automatic screen, so arranged that the beam of light can not fall upon the film until the machine has come up to speed. In this way, if the operator stops the movement of the film, the filter is interposed between the arc light beam and the celluloid.

The department has also prescribed certain regulations affecting the use of resistances, flexible connections and arrangement of auxiliaries.

The Department of Electricity, Water and Gas, in order to make violations of its recommendations as few as possible, is now issuing permits good for thirty days. The number indicated on these certificates must correspond to the number of the name plate on each machine. This obviates, in a measure, the possibility of the operator securing a number of certificates upon one good machine by moving it from place to place, and operating a corresponding number of bad machines in different sections of the city.

Methods of Getting New Business

A DEPARTMENT DEVOTED to the COMMERCIAL DEVELOPMENT of CENTRAL STATIONS

Managers are Invited to Contribute Suggestions for Methods of Increasing the Demand for Electric Service

EDITED BY CHARLES A. PARKER.

Tactful Trifles.

Almost as sensitive as is a column of quicksilver to the weather changes, so is the great public sensitive to nearly every move and act of the public service corporation.

And so the central electric station is numbered among the powers capable of bringing down esteem or calamity on its own head.

Of course, there are some rather irritating measures which the central station can hardly avoid, as for instance the rendering of regular monthly bills, and the seemingly unreasonable insistence that they be paid.

On the other hand, there are any number of trifling practices which the central station might indulge in for its own, as well as its patrons' good. There's the sharp answer on the telephone that rankles in the bosom of patrons who have grown to half expect discourteous treatment whenever they have any wrong to right. They hardly expect their claim to be given much attention, and so far as securing the simplest of information is concerned, they looked to be dismissed curtly and, sometimes, disdainfully.

It is with halting trepidation that the ordinary mere mortal approaches the usual central station, seeking a hearing. Likely we are not to blame for this feeling. Likely we are ready and anxious to right any wrong, or to give ear to our clients' plaints. It is not ourselves, individually, but a condition which exists, much to the injustice of every fair-minded central station. Still, public service corporations are universally so regarded by the general public.

Can't we tutor our office help to estimate themselves just a little below self-esteemed czars and despots, when they have occasion to talk with our customers through the telephone, or even face to face? This is one of the trifles that is big.

There's the meter man too—a being of acknowledged gruffness and, many times, short answers. He could be trained to assume a little more of the human garb and manner. Ofttimes, coming, as he does, in close connection with our valued customers, he is used as a medium through which customers judge our entire policy. There is no reason why he should be the very antithesis of our polite and considerate solicitor who precedes him. His mission, surely, is not to destroy the good-fellowship feeling between customer and central station which the solicitor before him has studiously effected.

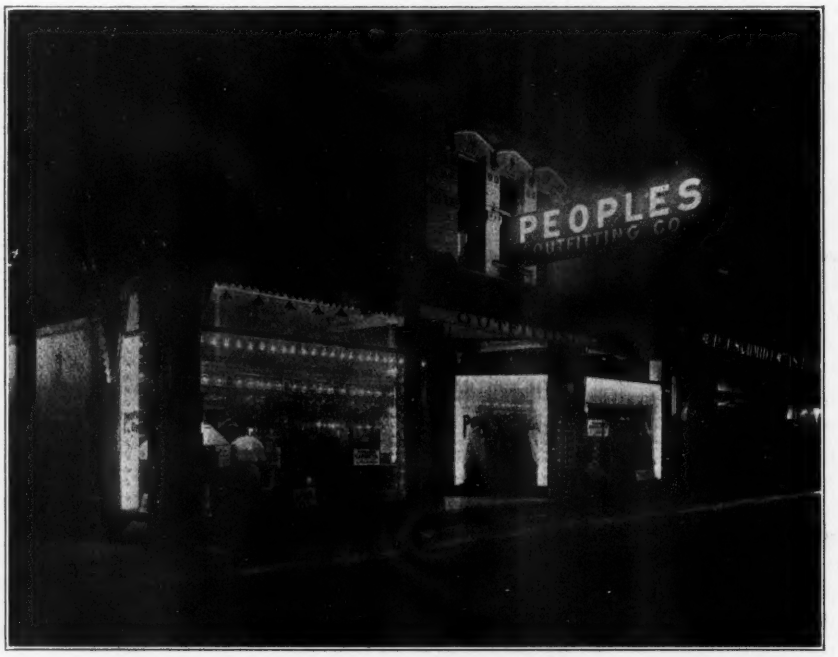
Even a dirty, neglected office in the central plant, where the public is wont to call now and then, has its influence on customers. A bedraggled office smacks strongly of a bedraggled service all along the line, and impresses people with the idea that, after all, electricity is not all that it might be.

Likewise, an ill-kept sign in front of some customer's store does not augur much for the central station company's interest in its patrons, or much regard for the service it is giving.

Poles in the wrong place, wires that annoy folks, and other conditions which seem trifling to the central station, have a remarkable capacity for creating remonstrances, ill-will, and unfavorable comment, to the extent that the hurt one will conjure up things against us and discourage our further possible prospects among their friends and neighbors.

So much for fostering the good-will of the public—not the public as a homogeneous whole, mind you well, but the public divided into single individuals.

Newspaper advertising has its part to play, also. While there is little likelihood of newspaper advertising arousing real enmity on the part of the public, it is too often the case that newspaper advertising arouses nothing.



A suggestion of what can be accomplished in electric window lighting; a few windows like these make the other merchants "sit up and take notice."

So long as publishers remain unreasonable enough to insist upon pay for space, why not make that space a paying investment? Why not give the people something worth while to think over in our advertisements? Folks have a liking for facts and figures when related to a proposition they are willing to consider.

What sort of child-like people have we that we should expect to convert them to electricity by bold, sweeping, general glorification statements in our advertising?

Let's get down where they live and talk

sense and plain facts and figures to them, so that they may heed and cogitate and work out their own salvation.

Considerate treatment, an evidence that we appreciate everybody's patronage, a close watch-out for the trifles, coupled with a logical, sensible, understandable campaign of advertising, will do much toward reclaiming those we are in danger of losing, and winning new customers who have learned to look upon us as pretty good fellows after all.

Let's quit knocking the chip off the public's shoulder. Let's shake hands and make up.

Under this general heading we shall present to our readers a series of bright, stimulating talks to solicitors, which, we believe, will prove valuable to managers of new-business departments in suggesting points which they can profitably bring out in their occasional meetings with the company's representatives.

We shall gratefully accept contributions and suggestions from any of our readers.

Lecture day again, boys.

To-day I want a little heart-to-heart talk with you all on a vital subject. It's enthusiasm.

Some old wiseacre once said it took the incubator of enthusiasm to hatch out the eggs of success. And he's right, fellows.

If I were asked to name one of the greatest causes of failure in the salesmanship line, I'd unhesitatingly put a big cross alongside of "lack of enthusiasm."

There are no two ways about it. Without enthusiasm no man can become a real success in his work. It keeps you buoyed up to concert pitch. It imparts itself to others. It gets their attention and interest. It helps in hundreds of other little ways. And, backed up with the right talk, it sells goods. There's no other business tonic like it. Enthusiasm, plus persistence, plus faith in yourself, are a trinity fortune never turned down yet.

To bring the subject right home to us, take the case of Smith and Morse. Both these fellows entered our employ at the same time. Smith had just ordinary brains and ability, but he entered into his work with his whole heart, body and soul. Morse came right from one of the leading universities, where he had been graduated with high honors. Coupled with his college training, he had great natural talent, but he lacked enthusiasm to make them effective.

Well, you know the result. Smith is now one of our most valued representatives, while Morse, within six months, was looking for a job that didn't require enthusiasm.

Enthusiasm, and the lack of it, mean the difference between success and failure. Yet how little we realize it.

Remember, it's the chap who keeps after a thing with dogged persistence and courage—whose very enthusiasm and belief in his work create like effects in others—who turns stumbling blocks into stepping-stones—he's the one who walks in at the end of the season with the biggest string of contracts.

You'll never convince a man and clinch the order unless you have the proper enthusiasm, and absolute faith in yourself and your proposition.

All of which leads nicely up to the main question: Are YOU enthusiastic enough in your work? Are YOU fully satisfied with yourself and results? Couldn't those results be appreciably bettered with a little more hustle and enthusiasm on your part? Wouldn't a little extra effort and work bring us in a few more contracts for current?

Something entirely new and different in electric signs. Don't you know of a few firms in your town to whom such a sign would appeal?

What if you are turned down again and again? Don't get discouraged. Bob up serenely, determined to work just as hard to land prospect No. 20 as you worked for the nineteen before him.

In short, let us all get up on our toes and dig—enthusiastically, persistently, everlastingly, for more current contracts for the company that puts up the wherewithal for us to live. That's the true success spirit, boys, and don't you forget it.

Under this heading we shall, from week to week, present to our readers a little series of inspirational aphorisms (original, aboriginal and selected), which will, we believe, prove stimulating and suggestive to those who are interested directly or indirectly in the sale of central station current.

Remember municipal ownership in every case has increased the municipal debt.

Remember that municipal ownership has increased the local taxes in nearly every case.

Soliciting is an art—study it.

Even if you are not a natural conversationalist or diplomat, you can cultivate the necessary qualities.

Remember you are a cog in the wheel—don't disdain the rest of the machinery.

A wide-awake, enthusiastic manner always makes a good impression.

Cultivate self-confidence and learn to use your judgment.

Learn to do things and to do them right.

Remember there is always something to be learned—keep your eyes and ears open.

Listen to suggestions—you may derive benefit from some of them.

Remember you are out for business, not to give a free show or tell funny stories.

Advertising that pays is a business necessity. You are an advertisement for your company. Look to it that you are a paying one.

"There is nothing that has bin discovered yet, that iz so skarse as good hoss sense, about twenty-eight hoss power."

"Good, hard-pan sense iz the thing that will wash well, wear well, iron out without crinkling, and take starch without cracking."

"Good, old-fashioned common-sense iz one of the hardest things in the world to

out-wit, it iz az honest az a loaf of good domestic bread, always in tune, either hot from the oven or eight days old."

It will be our endeavor, from week to week, to present in this department brief notices of activities among the central stations, as gathered from men who are in the field and, consequently, in close touch with the progress of the new-business idea and its acceptance by central station managers. Contributions to this department are solicited, and will be received with much appreciation by the editor.

If you are doing something a little better than or different from the other fellows, and think it would make interesting reading to ELECTRICAL REVIEW readers, send in your schemes and plans. They will be gladly received.

Address all communications to Charles A. Parker, care of the ELECTRICAL REVIEW.

The Malden Electric Company, of Malden, Mass., recently moved into its new offices on Washington street, and certainly has something to be proud of, even in the eastern end of Massachusetts, where so much that is good and new can be seen.

The combined offices and display rooms occupy over 6,000 square feet of surface on the ground floor alone. Then the basements are made use of for filing cases, stock rooms, etc. The premises are divided into three compartments on the ground floor which has a frontage of seventy-five feet—one for gas offices, one for electric offices, and the other for general display and demonstration rooms. In one department the company conducts a weekly cooking class, making use of the various modern appliances, under the supervision of a competent demonstrator. A nominal charge is made to the members of the class, which secures a much more prompt and regular attendance than if conducted without charge. A competent solicitors' service is maintained, and a thorough canvass of all territory is constantly kept up.

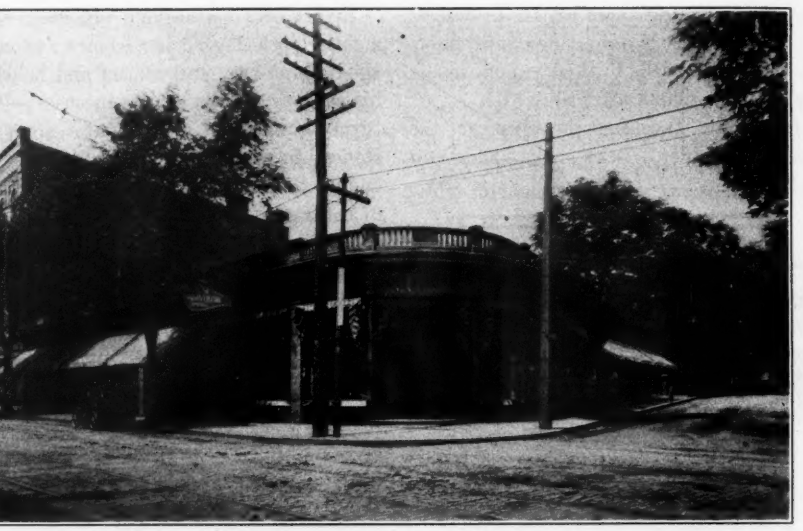
It would be a tedious detail to undertake to enumerate the various devices which are kept on exhibition in these beautiful and spacious display rooms, but it is enough to say that everything that is good and efficient and up-to-date is to be found.

The Grand Rapids Edison Company, of Grand Rapids, Mich., has done considerable campaign work along the lines of interesting Grand Rapids folks in the subject of electrical cooking. One of the plans is in the nature of an offer to furnish a complete electrical kitchen equipment—oven, griddle, broiler, cereal-cooker, eight-inch stove, seven-inch frying-pan, coffee percolator and special kitchen table, with all the necessary switches and plugs, for $65. This has been promulgated through the medium of the attractive monthly bulletin which is issued by this company, and also in the newspapers, which are used quite extensively.

One of the company's catch phrases is: "You are living in an electrical age—take advantage of it." Another one: "If you love your wife, give her electricity, the smokeless, explosionless, matchless, light and fuel."

Thomas F. Bechtel, manager, is himself a man of ideas and has considerable knowledge of the advertising business, with the result that many effective individualisms may be discerned in the wording of the various advertising matter used by this company.

Another offer brought out in the Grand Rapids company's bulletin, which is, we believe, calculated to inspire and stimulate interest, is the following; "It is possible to wire a five-room house, or five rooms in any size house, complete, with fixtures ready for lighting, for $20. Ask us for full information."



The well-kept and attractively located office of the Malden (Mass.) Electric Company.

The manager's private office, Malden (Mass.) Electric Company.

The general offices of the Malden (Mass.) Electric Company.

Apprenticeship.

Mr. James Parsons' paper on "Apprenticeship," read before the Society of Arts on January 30, deserves more than passing notice, since it touches upon one of the most important factors bearing upon industrial economics. The system of apprenticeship has been with us, in one form or another, for many centuries. In England it was widespread and important, both in the early history of trade and from its later connection with the English poor-law system, under which apprenticeship gave a right of settlement. As far back as the twelfth century legislation on the subject was passed, and by a statute of Elizabeth it was in general required that every person exercising a trade should have previously served as apprentice to it for seven years. One hundred years ago, however, the statute was repealed by legislation, and the term of apprenticeship is now determined by the mutual convenience of the contracting parties. Mr. Parsons favors a return to one of the older forms of apprenticeship, modified, of course, to enable the young apprentice to attend technical classes. The paper was largely an account of the objects and work of the apprenticeship and skilled employment committee, and it showed how the cooperation of employers with district committees could render the system of apprenticeship more effective and beneficial. The question is one which has an important economical significance, and must, in consequence, be approached from a strictly economical standpoint—a fact which the author of the paper seems at times to overlook. We can only deal here with the engineering branch of the subject, but it must be admitted that the craftsmanship and personal skill once demanded of engineers are now almost eliminated by the introduction and increasing application of machinery. Subdivision of labor is another element which plays a significant part in keeping down handwork, thus lessening the amount of skill and dexterity required of an employé, while an apprentice has little opportunity for obtaining a thorough all-round training in even a particular branch of engineering. An apprentice to electrical engineering, for example, is—if the firm to whom he is apprenticed are manufacturers of electrical plant—made to serve his apprenticeship either in the machine, the fitting, the winding, or other shop, and at the end of his term has probably little or no knowledge of the work appertaining to any department other than that in which he has served. As a rule, comparatively little time is required to instruct an apprentice in any particular department of work, for the few details there are to be learned are soon acquired by a youth of ordinary intelligence. In consequence of the lack of change or variety in the work, or the meagre demand for brain work, the apprentice's mental faculties become sterile; he acquires idle and slothful habits, and finally loses all real interest in his work and in his employer's welfare. Even the most diligent worker is liable to be influenced by the loose atmosphere of the workshop which even the most rigorous management can not wholly correct, and which is created by the presence of workmen who have not much sympathy with their employers' aims. The long hours which apprentices are called upon to work is also inimical to the best results. It is surely impossible to hope that young people, however diligent they may be at the bench or in the evening technical schools, will be in a condition in the evening to deal with intricate mathematical or scientific subjects having a bearing on their training. It is clear, therefore, that the old idea of apprenticeship is untenable in the engineering industries, and that, instead of attaching supreme importance to binding boys to such industries for a stipulated number of years, greater good will result if the educational qualifications and the habits of boys are rated at their true value. Mr. Parsons brought forward a scheme for establishing a kind of employment bureau between the schools and the masters of different trades, and Professor W. E. Dalby, in contributing to the discussion on the paper, was right in commending such a scheme. He referred to his own experience, and said that when June came round every year he found that one of his chief duties in connection with the department over which he presided at the Central Technical College, was to deal with the appointments that students were trying to obtain by fitting the employer to the student. That shows the need for some central bureau or employment agency which would bring the two classes together, and Professor Dalby's suggestion that an attempt should be made to bring the Employers' Federation of London into coordination with the schools and colleges is certainly a step in the right direction as far as the problem in London is concerned.—*The Electrical Engineer (London), February* 15.

A Large Order for Electric Cars.

The Brooklyn Rapid Transit Company, Brooklyn, N. Y., has placed what is probably the largest single order for new cars ever given by any railroad company in the country. The contracts call for 100 of the newest type of cars for elevated railway service, and 100 surface cars. The contract for the surface cars has been awarded to the John Stephenson Company, of Elizabeth, N. J. The cars will be of the latest type of convertible summer and winter cars. They will be equipped with air-brakes and storm-proof vestibules. The first of the surface cars will be ready about the middle of July. The cost of each car will be about $6,000.

The elevated cars will be steel framed, and the contract price is $14,000 each. Fifty of them will be built by the Jewett Car Company, of Newark, Ohio, and fifty by the Laconia Car Company, of Laconia, N. H.

The contracts aggregate a total of $2,000,000.

The Hudson & Manhattan Tunnel.

The rapid transit commission of New York city has filed with the secretary of state at Albany a certificate modifying the terms of a certificate issued February 2, 1905, to the New York & New Jersey Railroad, known as the Tunnel Company, and operating from New York city to New Jersey. The Tunnel Company is one of the corporations merged into the Hudson & Manhattan Railroad Company. The certificate, which has been accepted by W. G. McAdoo, president of the Hudson & Manhattan Railroad, fixes at $1,000 the annual rental to be paid the city of New York by the railroad company for exits from its tunnel to be situated in Fourteenth street, near the westerly side of Sixth avenue; Twenty-third street, near the westerly side of Sixth avenue, and two on Twenty-eighth street, near the easterly side and near the westerly side of Sixth avenue.

American Institute of Electrical Engineers.

The 217th meeting of the American Institute of Electrical Engineers will be held in the auditorium of the Engineers' Building, 33 West Thirty-ninth street, New York city, on Friday evening, March 29, 1907, at 8 P. M.

Papers on "Lightning and Lightning Protection" will be presented by C. P. Steinmetz, E. E. F. Creighton and D. B. Rushmore.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

A New Decade Testing Set.

The illustration herewith shows a new type of testing set placed on the market by Queen & Company, Incorporated, of Philadelphia, Pa. It possesses some interesting features not the least of which is its small size, the outside dimensions being nine and one-quarter inches long, seven inches wide and seven and one-half inches deep with a total weight of about eleven pounds. This compact shape is due primarily to a radical departure from the orthodox design of decade testing sets which, as will be seen from the illustration, consists in arranging the rheostat sections in the form of arcs, while the bridge sections occupy intermediate positions within these arcs. Practically no part of the rubber top, therefore, in this design is dead space.

A new type of construction has been followed in the contact plugs and switches, the latter being straight leaves beveled at the outer end and making contact with an under surface of each individual contact block, the under surface being chosen as naturally remaining much cleaner and dust free than the usual top style contact. This style of brush contact was adopted only after a long series of experiments in actual practice where its low initial resistance and constancy over long use were thoroughly demonstrated.

Each rheostat row carries ten coils of the usual denomination and each ratio arm four coils, while additional blocks are here provided so that one arc can be open-circuited, and in other cases the opposite arm short-circuited, the latter being frequently desirable in such cases as the Murray loop test.

The resistance coils are wound with manganin wire properly shellacked and baked and the resistances, therefore, require no correction over wide changes in temperature.

The galvanometer is of the D'Arsonval type with a long, narrow coil, securing, thereby, a high sensibility with dead-beat action.

A specially arranged Ayrton shunt allows the galvanometer a much wider range of application than heretofore, shunting values of 0.1 and .01 being provided. Keys are in series with both battery and galvanometer circuits and can be locked down to make permanent contact by means of a thumb nut at the back of the strap, or both keys may be depressed with the same finger when necessary. Binding posts and switches are provided so that the set can be used in connection with an outside galvanometer or outside batteries if this is ever desired.

The battery consists of six special dry cells mounted in the base of the set, with their terminals extending through the side of the case, but the end of the tip being below the outer surface. If the instrument were inadvertently placed on its side the terminals would not be short-circuited. By removing four small screws from the base of the case the cell compartment is opened and the batteries can be exchanged without unsoldering or re-wiring any connections. As this compartment is entirely separate from the rest of the case and securely sealed therefrom there is no danger, during the changing of the batteries, of dirt getting into the interior around the galvanometer and resistance coils.

A New Decade Testing Set.

A Large Electric Sign.

One of the largest electric signs in the world is to be installed at Detroit by the Morgan & Wright Company, in the near future, to cost several thousand dollars.

A thorough study of electric signs was made by a special committee of the Morgan & Wright Company preparatory to placing their order for a sign. The committee visited several cities in which were installed some of the largest and best electric signs in this country, and after carefully making up their minds as to the kind of a sign they wanted, they requested the various sign companies to each make a six-foot letter R in their best method of construction, and to install it on the roof of their new building facing the Detroit river. After the officials had made a careful and exhaustive examination of the details of construction of the different letters, they were all illuminated at the same time and viewed from different angles and points by the committee at night; they viewed them from Belle Isle bridge, then crossed over to Belle Isle to a distance

over a mile from the building, afterward taking a boat and viewing the letters from different points on the river to find out which letter had the greatest angle effect. The same kind of a test was made in daylight to find the best day effect.

The specifications stated that the sign was to be installed on the two buildings facing the Detroit river; to extend from the extreme sides of the buildings and bridge over a span of thirty-six feet, a distance altogether of 140 feet. The height was to be thirty feet, and the sign to be installed on an angle-iron frame of sufficient size and strength to support the letters and resist the strong wind pressure of this location, the letters to be made of twenty-two-gauge galvanized iron.

After much deliberation the committee selected a letter of the concave groove method of construction with a face of one and one-half inches for daylight effect. This letter was made by the A. & W. Electric Sign Company, of Cleveland, and is known as the A. & W. groove letter.

The A. & W. Electric Sign Company was also awarded the contract for installing the sign. The sign will be 140 feet long and thirty feet high and will extend from the roof of one building across a span of thirty-six feet to the roof of a second building. The name "Morgan & Wright" will form the top line in letters ten feet high and "Detroit Rubber Works" the second line in letters six feet high. The face of the letters will be gold leafed for day effect and the sides painted green, which will make an excellent combination for a day sign.

The sign will require about 1,400 lamps and will be installed ready for lighting about April 1.

The A. & W. Electric Sign Company installed four large signs recently on the four corners of the Pardridge & Blackwell Building in Detroit. They consist of four "hearts" forty feet high with the letters P. & B. twelve feet high inside the hearts.

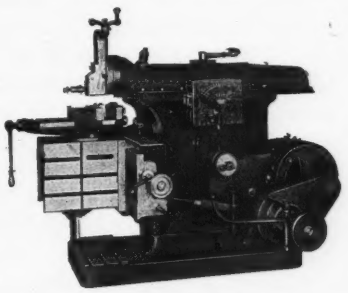
New Motor-Driven Shaper.

The illustration herewith shows an interesting application of a General Electric continuous-current motor to a high-speed, quick-stroke, twenty-four-inch shaper recently manufactured by Gould & Eberhardt, of Newark, N. J., for the National Tube Company, Lorain, Ohio.

As will be seen, the motor is mounted on the back of the main column of the shaper, thus making it integral with the tool, and at the same time keeping it well up from the floor, where it will be protected from dirt or sweepings. The compact cylindrical construction of the motor adapts it well to the machine so that a symmetrical unit results. Power is transmitted to the main shaft of the shaper through a Morse silent chain.

One of the particular features of interest in this electrically driven tool is found in the fact that the motor is not stopped and started each time that the tool itself is stopped or started. The motor may run continuously and by means of the long, curved lever shown at the right in the view, a clutch is thrown in or out, as occasion requires, thus giving perfect control of the cutting head without the strain or shock involved in starting and stopping the motor instantaneously.

A very desirable feature in connection with the clutch is the mechanical brake, which enables the cutting head to be



Motor-Driven Shaper.

brought to rest almost instantly during any portion of the stroke.

The arrangement for governing the transverse feed of the table is ingenious and effective, as is also the means for supporting the table on the extended base when heavy work is being machined.

Heating and Ventilating a Modern Hotel.

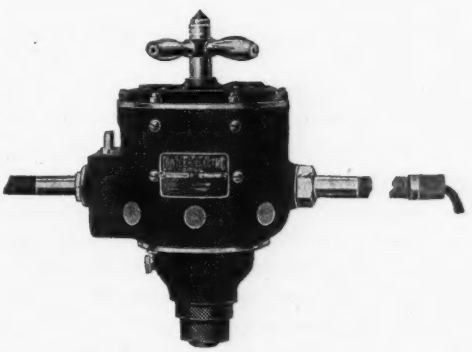
The heating and ventilating equipment of the Hotel St. Regis, New York city, is of unusual interest on account of the use of the indirect-steam-heating system for all public portions and 550 guests' rooms in a building eighteen stories in height, direct radiation having been eliminated in all portions except in the servants' dormitory upon the eighteenth floor. For this indirect heating service a number of independent blower systems are used with cheesecloth filter intakes, automatic temperature control on heating stacks and humidifiers for automatic regulation of the moisture carried in the air. The systems are in all cases designed to maintain, in connection with the exhaust ventilation system, a uniform temperature of seventy degrees Fahr., in zero weather, all having exhaust vent connections through register openings or fireplace flues. A feature of the installation is the subdivision of the heat supply to the guests' rooms upon the upper floors into three nearly equal divisions, each of which is supplied by a heating fan on a floor underneath for upward delivery.

The blowers are all three-quarter-housed steel plate fans, built by the E. F. Sturtevant Company, of Boston, Mass., with top vertical outlets, delivering to overhead lines of duct work, which supply the delivery systems on the floors above. They are located with short direct connections to the tempering coil casings and all have individual motor drives. The motors are all of direct-current type operated from the 220-volt power mains of the hotel electrical distributing system and are equipped with speed-regulating starting rheostats, allowing three variations of speed from two-thirds speed to full speed by field control. The motors are all mounted on brick piers and drive the fans through flexible shaft couplings.

The "Duntley" Air-Cooled Electric Drill for Alternating Current.

At the recent electrical show held at the Coliseum, Chicago, Ill., a great deal of interest was manifested in the "Duntley" air-cooled electric drill for alternating current, which was there shown in operation for the first time by the Chicago Pneumatic Tool Company, Chicago, Ill.

A small alternating-current motor, in which large starting torque, durability, efficiency and light weight are prominent



The "Duntley" Air-Cooled Electric Drill for Alternating Current.

characteristics, has been developed especially for the "Duntley" electric drill. These drills are equipped with single, two and three-phase motors. The single-phase drill will start under considerable load, and weighs no more than a direct-current tool of the same capacity. It contains no brushes nor any moving contacts whatever,

the rotor being bar-wound and operating as in an induction motor.

Two and three-phase drills are made on the induction-motor principle, with bar-wound rotor, there being no brushes or moving contacts in the apparatus. These tools are very powerful and will develop even more power than the corresponding sizes of direct-current drills.

The absence of commutator, brushes or any moving contacts renders these tools especially desirable on account of freedom from any tendency to spark or possible trouble from flying dust or particles encountered in some classes of work.

The drills are regularly built and carried in stock for sixty cycles, one, two and three-phase, and 110 and 220 volts.

The mechanical features of the two and three-phase drills are the same as the single-motor direct-current drills, which have been fully described in previous issues of the ELECTRICAL REVIEW. The planetary gear and ventilating fan have been retained.

The Chicago Pneumatic Tool Company has also placed on the market portable electric grinders and blowers for both alternating and direct current.

"A Notable Order for Measuring Instruments."

TO THE EDITOR OF THE ELECTRICAL REVIEW:

Your issue of March 16 contained an article entitled "A Notable Order for Measuring Instruments," which, if accepted by those interested in the art of electrical measurements, conveyed misleading information regarding the sensibility that is, and has been, obtained by instruments constructed upon the Weston principle.

It was specifically cited in that issue that meters recently constructed by the Keystone Electrical Instrument Company, which while embodying the "dead-beat" and "accuracy" characteristics demanded, were so designed as to "give full scale deflection on sixty volts with 100,000 ohms resistance, the resistance to be self-contained in the instrument."

Attention was directed to the fact that this sensibility "meant the construction of a commercial instrument with pivoted moving coil having a resistance of 1,667 ohms per volt, and that the makers had but one-sixteen-hundred-and-sixty-seventh (0.000599) of an ampere at its disposal for full scale deflection."

You further stated that "it is believed these are the most sensitive instruments which have been put into commercial use in the shape of a calibrated instrument with pivoted moving coil."

In view of the publicity given to those statements in the article, we consider it will be of interest to you and your readers to ascertain that for at least the past fifteen years this company has been furnishing commercial instruments of the portable type guaranteed to an accuracy of one-fifth of one per cent, giving full scale deflection with 600 volts through a self-contained resistance of one megohm (1,000,000 ohms), so that there has been no novelty introduced to the art by producing an instrument with a resistance of 1,667 ohms per volt.

It is perhaps still more interesting to note that we have during the past five or six years furnished numerous customers with several hundred of our standard round pattern switchboard instruments, designed to operate on a potential of forty volts through a self-contained resistance of 100,000 ohms, which sensibility represents a resistance of 2,500 ohms per volt and a current required for full-scale deflection amounting to 0.0004 amperes (two-thirds of the amount specified in the aforesaid article).

The particular examples herein mentioned do not, however, indicate the extreme limitation of the sensibility of instruments of this type when properly manufactured, for should the requirements of any branch of the electrical industry demand it, there is no reason why voltmeters comprising all the essential characteristics should not be furnished with a resistance of 5,000 or more ohms per volt, or a current consumption of 0.0002 amperes for full-scale deflection.

WESTON ELECTRICAL INSTRUMENT CO.
CAXTON BROWN, Secretary.
Waverly Park, Newark, N. J., March 18.

Single-Phase Generator at Belleville, Ill., Works Economy in Feed-Wire Copper.

Belleville, Ill., having some 20,000 inhabitants, possesses a greater number of manufacturing industries of various kinds, especially foundries, than is usual for a town of its population. The Belleville Gas and Electric Company, which has been supplying both light and power for these factories for several years, for a long time maintained a 500-volt direct-current service which, it was found, required considerable expenditures for feed-wire copper in order to extend and enlarge its service to take care of new factories scattered along the rights of way of several railroads passing through Belleville.

A means of overcoming this difficulty was presented in the alternative of supplying power from single-phase lighting circuits or of installing a polyphase distributing system for power purposes. The latter plan involved expensive changes, so that the use of a single-phase system was adopted and an Allis-Chalmers Corliss engine direct-connected to an Allis-Chalmers single-phase generator was the equipment selected to solve the difficulty. The generator is a 550-kilowatt, 2,300-volt, sixty-cycle machine of standard design, and the engine is one of the well-known Reynolds-Corliss type, thirty inches by forty-eight inches.

While a considerable portion of the present output is through a 500-volt, direct-current generator, the 500-volt system is not being extended. All new business is taken on the single-phase alternating-current circuits, and some business has even been changed from 500 volts, direct current to single-phase, alternating current, because of better voltage regulation on the alternating-current circuits. Out of a connected load of about 900 horse-power, 500 is in direct-current motors.

Consolidated Gas, Electric Light and Power Company, of Baltimore, to Buy Power.

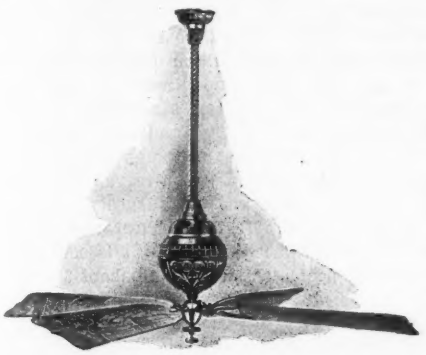
It is announced that the Consolidated Gas, Electric Light and Power Company, of Baltimore, Md., has made a contract with the McCall's Ferry Power Company to furnish electric power to Baltimore, Md. The power will be generated thirty-eight miles from Baltimore, and will be brought to that city by overhead wires. The high-tension current will be reduced in transformer stations for distribution throughout the city.

The Sweeten-Crossan Electric Company.

In the issue of the ELECTRICAL REVIEW for March 9 the announcement was made that "Sweeten, Crossan & Company" had closed a contract for the Philadelphia agency on Brilliant lamps. The company designation was in error. This should have been "Sweeten-Crossan Electric Company." The company's headquarters are at 816 Arch street, Philadelphia, Pa.

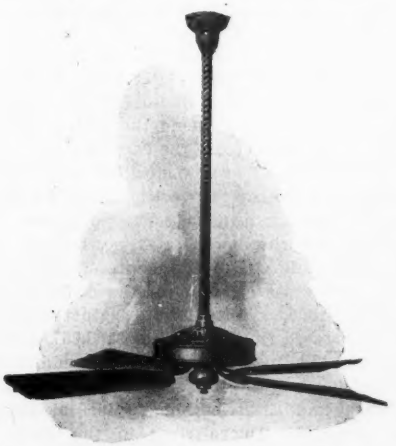
The "Tuerk" Alternating-Current Ceiling Fans.

The Hunter Fan and Motor Company, Fulton, N. Y., is meeting the demand for the "Tuerk" alternating-current ceiling fans with a handsome line of apparatus, which, while conforming to the designs which have been standard for a number of years, has been improved in some of the details, so as to more than ever meet modern requirements of finish and adaptability.



TUERK TYPE A—4-BLADE CEILING FAN.

Fig. 1 shows the type A four-blade fan. These fans have a sixty-inch sweep and operate at 175 revolutions per minute, consuming from 105 to 110 watts. The motor is of the induction type. Two of the blades on this fan can be adjusted at will while the fan is in motion, setting them to any angle. An electrolier attachment can be furnished with two, three, four, five or six lights, as desired.



TUERK TYPE C—4-BLADE CEILING FAN.

The electrolier fan can also be furnished so wired as to use the lights and fan independently of each other. Where the electrolier is used, however, the fan adjustment at various angles is not possible.

Fig. 2 shows the type C four-blade fan. These fans are made with both two and four blades. The two-blade fans have fifty-inch sweep, and the four-blade fans fifty-two-inch sweep. The fans operate at 225 revolutions per minute. The motor is of the induction type. The type C fan can be made into an electrolier fan with two or four lights by adding electrolier stems, sockets and shades.

In addition to these two types the company manufactures the type B ceiling fan, which is furnished with a ventilated case and operated at two speeds—175 and 150 revolutions per minute. The company also manufactures the type D alternating-current deflector ceiling fan. This fan has five speeds, ranging from 500 to 1,050 revolutions per minute. The four steel blades run inside of a deflecting case, and are therefore adapted principally for banks, dining cars, billiard tables and restaurants, where one fan is used over each table. This type of fan may also be furnished with an electrolier attachment.

The type E fan is made with two or four blades, with sixty-inch sweep. It has two speeds—175 and 140 revolutions per minute. The "Tuerk" alternating-current column fan is furnished with two and four blades, with sixty-inch sweep. This is also furnished with a two-speed switch, and may be fitted with an electrolier attachment if desired.

Inspection Trip to Fort Wayne, Ind.

E. K. Gillette, Cincinnati manager of the Babcock & Wilcox Boiler Company, in conjunction with J. A. Brett, Cincinnati manager of the Westinghouse Electric and Manufacturing Company, and Arthur Brown, Cincinnati manager of the Westinghouse Machine Company, conceived the idea of visiting the Fort Wayne & Wabash Valley Traction Company's power plant as a compliment to Thomas Elliott, consulting engineer, of Cincinnati, who designed the plant.

The party left Cincinnati Saturday evening, March 9, at 8 o'clock, in a private train consisting of three Pullmans and baggage, and arrived in Fort Wayne at an early hour Sunday morning. The Westinghouse Electric and Manufacturing Company was represented by J. A. Brett, G. H. Gibbs, W. G. Leary and C. R. Gilliland. The Babcock & Wilcox Boiler Company was represented by Edward K. Gillette, F. C. Bitgood and Wm. A. Neisel. The Westinghouse Machine Company was represented by Arthur A. Brown, of Cincinnati. The Westinghouse Companies' Publishing Department, of Pittsburg, was represented by Norman G. Meade. Among the invited guests were Thomas Elliott, consulting engineer of the Cincinnati Traction Company; J. B. Bevear, manager of the Cincinnati office of the General Electric Company; Frank Strieby, railway department, General Electric Company; Herbert McNulta, chief engineer of the Cincinnati Traction Company; James H. McCabe, manager of the Cincinnati office of the Murphy Iron Works; Thomas J. Cookson, of the Cookson Steam Specialty Company; Edward McClintock, chief engineer of the Union Gas and Electric Company, Cincinnati; C. T. Hughes, manager of the Cincinnati office of the Ideal Engine Company; E. H. Lestetter, manager of the Detroit Stoker and Foundry Company; John Neil, of the John W. McGowan Company; Arthur P. Taylor, of the Charles Taylor's Sons Company; Louis Arnold, of the George Weiderman Brewing Company, Cincinnati; A. B. Jacobs, of Jacobs & Arnold, Cincinnati; M. S. Folger, of the Cincinnati Traction Company; V. T. Price, manager of the Cincinnati office of the Buckeye Engine Company; George Knapp, of the Post-Glover Electric Company, Cincinnati; Ralph P. Willis, of the R. P. Willis Company, Springfield, Ohio; George W. Cleveland and Wm. P. Hubbell, of the Cincinnati Inspection and Report Bureau; W. C. Greene, of the American Engineering and Specialty Company; A. C. Beattie, of the Beattie Electric Company, Cincinnati; Dan Delaney, of the Dearborn Drug and Chemical Company, Chicago; L. F. Rainey, of the Cincinnati office of the General Electric Company, and Charles Kilgour, second vice-president of the Toledo Urban & Interurban Railway.

A Correction.

On page 427 of the ELECTRICAL REVIEW for March 9 an unfortunate typographical error was made in describing the ceiling and desk fans made by the Emerson Electric Manufacturing Company, St. Louis, Mo. The statement was made that this company's ceiling and column fans are all "direct-current motors of the pure induction type." This should have read "direct-connected motors of the pure induction type."

New Power Plant for Cincinnati.

The Cincinnati Gas and Electric Company, through the lessee, the Union Gas and Electric Company, has acquired an extensive tract of land in Cincinnati, Ohio, on which to build a new power plant. The cost will aggregate about $1,500,000.

Current Electrical News

DOMESTIC AND EXPORT.

HUDSON RIVER POWER COMPANY TO ERECT LARGE POWER PLANT—Representatives of the Hudson River Electric Company are closing options obtained on land and water rights necessary for the development of a 30,000-horse-power electric plant, to be run by power obtained from the Delaware river. It is stated that $15,000,000 will be expended upon the enterprise. For several months last summer the company had engineers making surveys, soundings and borings along the Delaware, from Cold Eddy to Big Foul Rift. The plant is to operate the large cement mills, trolley lines and manufactories in the section.

COLORADO ELECTRIC MERGER—Negotiations for consolidating the Central Colorado Power Company, capitalized at $22,000,000, and the Northern Colorado Power Company, with a capital of $10,000,000, are being carried on by Myron T. Herrick, Thomas F. Walsh, Simon Guggenheim and others interested in the Central Colorado Power Company. When the negotiations are completed the combined company will be capitalized at $50,000,000, and will supply electric light and power to almost three-fourths of Colorado. The Central Colorado Power Company was organized last November, and Mr. Herrick says it immediately will expend $9,000,000 in Colorado and $40,000,000 more later.

MEXICAN STREET RAILWAY MERGER—The light and power and street railway interests of La Electra, S. A., and the Compania Industrial de Guadalajara, the competing concerns of Guadalajara, Mexico, will be merged by a combination of Mexico City interests. All arrangements have been practically completed. Principally concerned in the combination are the Banco Central and the Bermejillo banking circles. The holdings of the Compania Industrial will be purchased for a sum in excess of $2,500,000. The Bermejillos now control the stock of La Electra, and the Banco Central holds the bonds of that concern. In this way the merger of the Guadalajara companies will be effected and a new corporation formed. One effect of the merger will be to give Guadalajara electric traction at a much earlier date than was expected. It is probable that electric cars will be in operation in all sections of the city within ninety days. The Compania Industrial de Guadalajara is composed of French merchants of Guadalajara. La Electra is a Spanish concern.

CHEROKEE POWER COMPANY TO BEGIN WORK ON PLANT—Plats showing the location and resultant overflow land of the proposed one million-dollar electric power plant of the Cherokee Power Company, to be erected on Grand river, twelve miles southwest of Afton, I. T., have been filed with the secretary of the interior at Washington, D. C. The charter for the new company was secured on February 23. The proposed new plant will harness the waters of Grand, Spring, Neosho and Cowskin rivers, and Shoal, Brush, Five-Mile and Lost creeks, and will have a capacity of 15,000 horse-power. The new company is practically a Joplin enterprise and will furnish the Joplin mining district with light and power. In addition the towns of Vinita, Afton, Miami and Grove, I. T.; the Quapaw mining district, Baxter Springs and Galena, Kans., and other towns along a line fifty miles north to the Joplin, Webb City, Oronogo and Carl Junction mining districts, will be supplied. Condemnation proceedings to secure right of way over the overflow land near the proposed dam are now pending, and work on the dam and plant is to be hastened. The officers and directors of the new company are: Joseph Schneider, Joplin, president; Charles Moore, Joplin, vice-president; Thomas M. Reynolds, Afton, I. T., secretary-treasurer; W. G. Sergeant, Joplin, assistant secretary-treasurer, and Harry O. Bland, Afton, I. T.

SYRACUSE (N. Y.) TO HAVE LOWER LIGHTING RATES—The Syracuse Lighting Company, Syracuse, N. Y., has abandoned its fight against the reduction in gas and electricity rates ordered by the state commission of gas and electricity. John J. Cummins, president, for the company and for its associate corporation, the Syracuse Gas Company, has issued an announcement to the public that the commission's order will be fully complied with and that all litigation over it is ended. The order was to have been effective October 1. Because of the company's appeal to the appellate division of the Supreme Court, consumers have been obliged to pay the old rates. The order of the state fixes ninety-five cents per thousand cubic feet as the maximum price of gas, nine cents per kilowatt-hour for electricity until October 1, 1907, and eight cents per kilowatt-hour thereafter, and $68 per street arc lamp per year. It also refixes a standard of service for gas, requires an improved system for the inspection of arc lamps and establishes a classified schedule of rates for electric current for light, heat and power. The reduction in rates for gas and electricity will, it is estimated, mean an annual saving for the people of Syracuse of about $120,000.

BRILL COMPANY ABSORBS CAR-BUILDING CONCERNS—The J. G. Brill Company has transferred its business to a new corporation, chartered under the laws of the commonwealth of Pennsylvania, known as the J. G. Brill Company, the better to complete and deliver its orders throughout the country, and to bring within its control a more extensive equipment for the filling of its foreign orders. The new company has by specific agreement assumed all of the obligations and contracts of the old company, and has at the same time become owner of the entire capital stock of the American Car Company, the G. C. Kuhlman Car Company and the John Stephenson Company. The companies are located at vantage points in the car manufacturing industry throughout the country—the American Car Company, at St. Louis; the G. C. Kuhlman Company, at Cleveland, Ohio, and the John Stephenson Company, just outside Elizabeth, N. J. This consolidation means the doubling of the J. G. Brill stock, originally capitalized at $5,000,000. The new company now has $10,000,000 of equipment at its disposal. There is also contemplated the purchase of a large New England concern. Upon this plant the new company has an option. The old company will maintain its separate existence under the law for the filling of contracts entered into under its old status, but with the completion of these contracts it will cease to exist.

GUANAJUATO POWER AND ELECTRIC COMPANY—At a special meeting of the stockholders of the Guanajuato (Mexico) Power and Electric Company the proposition to amend the articles of incorporation of the company, so as to increase the capital stock from $3,000,000 to $3,500,000 was carried. The new stock issue of $500,000 is to be exchanged for the entire capital stock of the Michoacan Company. The Michoacan Company owns a concession from the Mexican federal government covering two water powers on the Angulo river, about thirty-five miles east of the present plant of the Guanajuato company. The gross earnings of the company for the year ending December 31, 1906, were $263,444, against $195,300 in 1905, and the net profit increased from $60,423 to $105,667, a gain of $45,244. With a view to meeting the demand for additional electric power in the Guanajuato mining district and in other sections, the Guanajuato Power and Electric Company is taking up additional water rights along the Duero river in the state of Michoacan, and a second hydroelectric plant will be installed. The company's present plant is on the Duero river near Zamora, and the equipment was recently duplicated, raising the capacity to 6,000 horse-power. Power is now transmitted to the city of Guanajuato and the Guanajuato mining district, to Leon, Celaya, Irapuato, La Barca, Ribera Castellanos and Ocotlan, and new lines are projected to San Felipe and the Pozos mining camp, both in the state of Guanajuato. Capitalists of Colorado Springs, Col., are largely interested in the Guanajuato Power and Electric Company. The company is responsible for the revival of the mining industry in the Guanajuato district, the cheap power making the treatment of low-grade ores possible.

ELECTRIC LIGHTING.

GUTHRIE, OKLA.—The electric light plant at Chickasha will be improved at an outlay of $14,000.

MANGUM, OKLA.—At an election held recently the proposition to purchase the electric light plant was defeated.

TECUMSEH, NEB.—At a special election the proposition to issue bonds for a new electric lighting plant, in the sum of $12,750, was carried.

COLUMBUS, GA.—An ordinance has been introduced calling for a bond election July 11 to vote on issuing $100,000 bonds for a municipal lighting plant.

NORWICH, CT.—The Stafford Springs Electric Light and Gas Company is planning to build a large power plant on the Willimantic river in Willington.

KENOSHA, WIS.—The city council has decided to submit the question of building a municipal light plant to the voters. The proposed plant is to cost $45,000.

CLIFTON FORGE, VA.—The city council has rejected the bid of W. G. Mathews and associates for the lighting franchise and has decided to readvertise the franchise for April 8.

ALEXANDRIA, VA.—At a regular meeting of the city council action was taken for the completion of the transfer of the municipal electric light plant to the Alexandria Electric Company.

GRAND FORKS, N. D.—It is stated that the city council is considering the matter of disposing of the municipal electric light plant, which has been operating at a loss for some time.

BAXTER SPRINGS, KAN.—The Spring River Power Company is making surveys for a power plant on Spring river, east of the Omaha mine. Power will be furnished to the mines in the vicinity of Baxter Springs.

SOUTH KANSAS, KAN.—The city council has entered into a contract with the Independence Electric Light Company for ten 3,000-candle-power arc lights to be placed on the principal corners in the business district.

COLUMBUS, OHIO—The council has fixed a maximum rate to be charged for electricity for lighting purposes in Columbus of eight cents, with a twelve and one-half per cent discount, or a net rate of seven cents per kilowatt hour.

JERMYN, PA.—The directors of the Household Electric Light; Heat and Power Company have elected the following officers: president, John Marrion; vice-president, Samuel Waters; secretary, T. L. Depew; treasurer, J. B. Griffiths.

WOONSOCKET, R. I.—The Woonsocket Gas Company has secured control of the Woonsocket Electric Machine and Power Company. The stockholders of the company voted to accept an offer for their stock of $155.15 per share made by the gas company.

COLUMBUS, IND.—The annual statistical report of the city clerk shows that during 1906 the city of Columbus paid only $31.03 each for its street lamps. The city owns its own waterworks and electric light plant, and there are 137 street lamps in the city.

HARTFORD, CT.—Circulars have been sent out to stockholders of the Hartford Electric Light Company notifying them of the proposed increase in the company's capital. There will be 3,000 ($300,000) new shares, one new one to each six shares now outstanding, raising the capital from $1,800,000 to $2,100,000.

MADISON, WIS.—A. O. Fox, of this city, has purchased for a company here the franchise for commercial lighting of Galena, Ill., for twenty-five years, and has secured a contract for the arc lighting of the streets of the city for twenty-five years. This includes turning over to Mr. Fox the present municipal plant.

MEDINA, N. Y.—The common council has granted a franchise to the Niagara Falls Electrical Transmission Company. The franchise, by its terms, provides that the company shall be in full operation at Medina by January 1, 1909, and that it shall supply light and power to the village at not to exceed $25 per horse-power.

INDIANAPOLIS, IND.—To increase the amount of direct current for down-town commercial lighting, the Indianapolis Light and Heat Company is about to build a new substation in East Ohio street. This substation will have a motor-generator capable of developing 1,000 kilowatts, besides a large storage battery to reenforce the one now located in Bird street.

ROME, N. Y.—At a meeting of the board of public works Chairman White and Clerk Midlam were appointed a committee, to which Mayor Kessinger was added, to visit several near-by cities and ascertain forms of contracts for street lighting, advertising for bids for the same, franchises, etc., so that the local board may advertise for bids for the Rome contract at the earliest possible time.

KAUKAUNA, WIS.—The present contract of the Kaukauna Electric Light Company for lighting the streets expires next October and the common council is investigating the question of municipal and commercial lighting so as to be able to act intelligently when the proper time comes. A strong sentiment exists among the aldermen in favor of a municipal plant operated in conjunction with the waterworks.

ALBANY, N. Y.—The state commission of gas and electricity has entered an order in the complaint of Mayor James G. Cutler against the Rochester Railway and Light Company, fixing the price of gas and electricity in the city of Rochester at ninety-five cents for gas from July 1, 1907, and eight cents per kilowatt-hour for electricity from October 1, 1907. These prices are on a par with those established by the commission in Syracuse.

BRISTOL, TENN.—Charters have been applied for by the Holston Mining and Manufacturing Company and the Holston Water, Electric and Power Company. The incorporators are: M. L. Fowler, J. G. Haun, E. S. Fraser, E. P. Kinsel and J. H. McCue. These two companies are made up practically of the same stockholders. The purpose is to develop a water power on the Holston river at Bluff City, and to generate electricity for lighting and power purposes.

LANCASTER, PA.—The Strasburg Electric Light, Heat and Power Company has elected the following directors: W. K. Bender and L. J. Bair, of Strasburg; H. S. Hunsecker, of Lime Valley; I. Haines Dickinson, Quarryville, and Henry C. Bair, Pittsburg. The following officers were elected: president, W. K. Bender; vice-president, H. S. Hunsecker; secretary and treasurer, L. J. Bair; solicitor, Charles G. Baker. The company will have plants in Edisonville and Wheatland Mills, both being operated by water power. The plant at Edisonville is already in operation. The company is already furnishing light to the boroughs of Strasburg and Quarryville, and it is expected will extend its system to Lampeter, Willow Street and Paradise.

SPOKANE, WASH.—The Columbia Power Company has been organized by W. T. Clarke, Marvin Chase and F. M. Scheble and its capital stock will be $100,000. The object of the company will be to furnish light and power to Wenatchee, and the surrounding country. According to the present plans of the promoters of the new proposition, the plant will be located some fifteen miles above Wenatchee river. Engineers who have gone over the ground estimate that fully 4,000 horse-power can be generated. To do this it will be necessary to construct a canal from a point two miles above the intake of the present high line canal to the site of the proposed power-house, a sufficient volume of water being secured in this way to develop a large amount of power.

WOONSOCKET, R. I.—An act has been introduced in the senate by Senator Francis Fagan, of Burrillville, incorporating the Northern Power Company, for the purpose of manufacturing and selling gas and electricity for power, heating and lighting purposes and supplying water for manufacturing, domestic and fire protection purposes in the towns of Glocester and Burrillville. The act names as incorporators Senator Fagan, Senator Charles Potter, of Glocester, and Charles M. Whittaker. The company is empowered for the purposes of its business to carry any works constructed by it over and under highways, streets and railroads and to enter upon any highway or street to lay pipes, build aqueducts and erect poles and wires on, over or beneath the surface. No such work is to be done without the consent of the town council of the town, however. The capital stock of the company is fixed at $250,000, and it is authorized to lease or purchase property rights and franchises in the two towns held by other persons or corporations, to an amount not exceeding its capital stock.

ELECTRIC RAILWAYS.

DANVILLE, ILL.—The Illinois Traction Company has begun the erection of an addition to the local power-house for a 3,000-horse-power generator, to furnish power for substations on interurban lines out of Danville.

JACKSON, MISS.—Kirkpatrick & Johnson, civil engineers of Jackson, have been engaged to prepare the plans and specifications of the electric railroad to be built at Yazoo City, and will begin work at once. This railway is to be owned by the city, and will be the first line of the kind in the state of Mississippi.

ATLANTIC CITY, N. J.—By the terms of an agreement made between the highway committee of the city council and the Central Passenger Railway Company the city is to receive $100,000 and a perpetual income of not less than $500 a year for the privilege of laying an extra track on Virginia avenue from Atlantic avenue to the city limits.

ELIZABETHTOWN, KY.—G. J. Lampton, the Louisville electric railway promoter, has begun surveying an electric railway route between Elizabethtown and West Point. The route is twenty-two miles long and parallels the old Louisville and Nashville pike. The cost of construction is estimated at between $10,000 and $12,000 per mile. The road will probably be completed to Bowling Green.

SPOKANE, WASH.—The Idaho Northern Railroad, which is building a railroad from Kingston to Murray and from Kingston to Coeur d'Alene, Ida., is planning to continue its line into Spokane. It is understood that practically all the right of way has been secured. The right of way from Kingston to Coeur d'Alene by way of Fourth of July Cañon and from Kingston to Wallace is also completed.

BURLINGTON, IOWA—The representatives of the Keokuk Columbus Junction Interurban have organized, the following officers being elected: president, J. E. Peterson, of New London; secretary, T. A. Craig, of Keokuk; treasurer, R. W. Wills, of Keokuk. A vice-president was selected from each of the towns represented. The object of the organization is to build an interurban from Keokuk to Columbus Junction.

ATLANTA, GA.—At a meeting of the directors of the Georgia Railway and Electric Company plans for the rebuilding of trolley lines in Atlanta, the extension of many others, the construction of the new line to Hapeville, the addition of new trolley cars, both improving the service and shortening the schedules, the erection of car barns and a repair shop were submitted, approved and the work will be started in the next thirty days.

NASHVILLE, TENN.—An order has been placed by the Nashville Railway and Light Company for thirty new double-truck street-cars, to cost on an average of $6,500 each, the contract calling for $200,000, delivery to be made in August. Besides this order for additional equipment, the Nashville Railway and Light Company has approved plans for improvements in the system to be completed within the year amounting to over half a million dollars.

PITTSBURG, PA.—A syndicate of Pittsburg men has applied for a charter to build an electric railway in Washington county, to be called the Burgettstown, Florence & Paris Street Railway, connecting at the three places named with the Pittsburg, Carnegie, Oakdale, McDonald and Steubenville line, now under construction. The incorporators of the new line are Charles W. Dahlinger, John W. Thomas, Robert L. Iams, Al Merver and I. W. Bingham.

BUFFALO, N. Y.—The Cheektowaga Railway Company has been granted a franchise by the town of Cheektowaga to erect a trolley line from the city line on Clinton street through the town to the intersection of the Transit Road and the Lawson Road, and thence to the town line of Lancaster. The length of the road will be six miles and it will be double tracked. The incorporators of the company, which is capitalized at $75,000, are Charles L. Williams, William H. Kinch and E. L. Ryan.

COLUMBUS GROVE, OHIO—The Columbus & Lake Michigan Railroad, built and projected by the late Benjamin Faurot, is to be turned into an electric line, and those in charge give out that work to this end will be commenced within the next few weeks. The road is now owned by the Schoepf syndicate of electric lines. At present the Columbus & Lake Michigan runs from Defiance through Putnam county to Lima, a distance of about seventy-two miles. An extension to Bellefontaine from Lima has been commenced.

FREDERICK, MD.—At a meeting of the stockholders of the Washington, Frederick & Gettysburg Railway Company in Frederick the directors were authorized to issue such additional stock as is necessary to build and equip the road. This stock is in addition to the first issue of $500,000, the capital stock of the company. The directors were empowered to issue mortgage bonds, not exceeding $400,000, to build and equip the road, together with the capital stock issue, from Frederick to the Pennsylvania state line.

TROY, N. Y.—The directors of the Hudson Valley Railway Company have received the resignations of the following directors: James O'Neil, John T. Christie, Harold K. Downing, J. A. O'Brien, of New York, and W. W. Blackmer, of Saratoga Springs. To fill the vacancies these were chosen: David Wilcox, president of the Delaware & Hudson Company; A. I. Culver, vice-president of the Delaware & Hudson Company; Cornelius F. Burns, of Troy, and James McElroy, F. B. Dixey, W. J. Mullin and Axel Eckstrom, of Albany.

ALTON, ILL.—The stockholders of the Alton, Jacksonville & Peoria Railway Company, at a meeting at the general offices of the company in Jerseyville, authorized an increase of the capital stock from $300,000 to $800,000. The stockholders also authorized a bond issue of $800,000. The road, which will be an electric interurban, running from Alton to Jerseyville, Carrollton, Whitehall, Roodhouse, Jacksonville and Peoria, is now under construction, from Alton to Godfrey, at which point the company expects to open up the line within a few weeks. The increased capital is for the purpose of completing the line to Jerseyville.

OWOSSO, MICH.—E. M. Hopkins, of Detroit, president of the proposed electric system from Grand Rapids to Detroit *via* Ionia, Owosso and Pontiac, says that his company is now ready to do business. The contract has been let for the construction of the four lines, Grand Rapids to Ionia, Grand Rapids to Belding and Greenville, Ionia to Owosso and Owosso to Pontiac. The Van Rensselaer Construction Company, of New York, has the contract and has already filed its bond of $100,000 for the performance of the work within the specified time. The first-mentioned line must be in operation within one year from date of beginning, May 11, 1907. The two roads next mentioned must be completed within eighteen months and the Owosso-Pontiac line within two years from May 11 next.

BROOKLYN, N. Y.—President Winter, of the Brooklyn Rapid Transit Company, has announced that in the future the various lines of railroad controlled by it will be operated under their individual titles instead of under the name of the consolidated system. The names of the various companies that will be used are: Brooklyn Heights Railroad Company, Brooklyn Union Elevated Railroad Company and the South Brooklyn Railway Company. Under the latter name will be operated the lines running through the south part of the city and to Coney Island. The Prospect Park & Coney Island Railway Company has been leased to the South Brooklyn Company, while the leases to the Brooklyn Heights Company of the Brooklyn Union Elevated, the Sea Beach Railway and the South Brooklyn Company have been terminated. It is thought the reclassification has been made to make ineffective any legislation that may be passed by the legislature looking to a five-cent fare to Coney Island.

FREDERICK, MD.—The Frederick & Middletown Electric Railroad Company and the Jefferson & Braddock Heights Railroad Company have merged into a new corporation, which will hereafter operate the entire road under the name of the Frederick Interurban Railroad. The capital stock of the new company is $1,000,000 and the incorporators named are Emory L. Coblentz, of Middletown; Thomas H. Haller and Richard P. Ross, of Frederick; James E. Ingram, Jr., and Robert P. Graham, of Baltimore. The character of the new corporation authorizes the company to build extensions. A director of the company stated that plans along this line were under consideration, but had not yet assumed definite shape. The Jefferson & Braddock line has recently been completed. It intersects the Frederick & Middletown road at Braddock Heights. In addition to building a new power-house or enlarging the present one the new company contemplates extensive improvements in the way of new rolling stock and additions.

PERSONAL MENTION.

MR. A. B. SAWYER, who has been manager of the electric light plant at Bay City, Mich., has resigned his position and will engage in business on his own account.

MR. GEORGE SILLIMAN has been appointed to the superintendency of the Danville (Ky.) Light, Power and Traction Company. Mr. Silliman has been with the company several months.

MR. MARTIN WITHINGTON, manager of the York State Telephone Company at Binghamton, N. Y., has been transferred to the Pennsylvania district of the company. He is succeeded by John McGinnis.

MR. R. W. HUTCHINSON, JR., whose technical work, "Long-Distance Electric Power Transmission," has just been published by the D. Van Nostrand Company, of New York, has an article in the March issue of *Public Service* on "The Question of Municipal Ownership," in which publicly owned utilities are heavily scored. Mr. Hutchinson is on the staff of the National Brake and Electric Company, Milwaukee, Wis.

W. E. RUNDLE, New York city, inventor of the Rundle graphic cable chart, has worked out a standard "cable and manhole" sheet, which he is now prepared to furnish licensees. These sheets, twenty-two inches by twenty-nine inches in size, each record ten miles of cable and are bound in loose-leaf black flexible leather binder. Some of the companies adopting his graphic method are the Interborough Rapid Transit Company, the Manhattan Elevated Railway Company, the New York & Queens County Railway Company, the Niagara Falls Power Company, the United Railways and Electric Company, of Baltimore; the Consolidated Gas, Electric Light and Power Company, of Baltimore, and the London Underground Electric Railways Company.

DATES AHEAD.

Underwriters' National Electric Association. Annual meeting Electrical Committee, New York city, March 27-28.

Ohio Independent Telephone Association. Annual convention, Columbus, Ohio, March 28.

West Virginia Independent Telephone Association. Wheeling, W. Va., April.

Iowa Electrical Association and Iowa Street and Interurban Railway Association. Annual meeting, Clinton, Iowa, April 18, 19 and 20.

Southwestern Gas, Electric and Street Railway Association. San Antonio, Texas, April 18-21.

Oklahoma Electric Light, Railway and Gas Association. Annual meeting, Oklahoma City, Okla., April 22-23.

Jamestown Tercentennial Exposition. Norfolk, Va., April 26 to November 30.

Texas State Electric and Gas Association. San Antonio, Texas, May 14-16.

American Society of Mechanical Engineers. Annual meeting, Indianapolis, Ind., May 28-31.

National Electric Light Association. Annual meeting, Washington, D. C., June 4, 5, 6 and 7.

Association of Railway Telegraph Superintendents. Annual meeting, Atlantic City, N. J., June 19-20.

American Institute of Electrical Engineers. Annual meeting, Niagara Falls, N. Y., week of June 24.

ELECTRICAL SECURITIES.

What is conceded to be the most remarkable week ever experienced in the stock market has passed into history, leaving considerable mystery as to the reasons for the violent fluctuations in prices, and the paradox that under the severest strain which the market has known since 1901, there is no record of failures. Following a six months' decline all along the line, many of the most stable securities lost from five to forty points in a few days' trading. Undoubtedly the present prices are more nearly normal values for these securities than have been touched in a year or more. The remarkable feature of the near panic was that, notwithstanding the tightness of money, the interests involved appeared for the most part to be outright owners of stock, so that the losses, whatever they were, have been stood by those confessedly most able to stand them. Prices have been so high that the outside public has been unwilling to invest heavily, particularly in a declining market, so that the small investor, or that one who suffers most when stocks go off a few points, has been almost entirely eliminated from the present experience. Following the terrific decline in prices toward the middle of the week, it took very little buying effort to stop the downward movement and initiate a period of equilibrium. It is doubtful, however, whether there will be any rapid advance from the present quotations, as what money may be available will likely be advantageously employed in building up manufacturing opportunities, rather than in speculating in stock issues. The heavy demand which the manufacturers have experienced for the last two years, and particularly during the last eighteen months, has effected a marked wear and tear upon machinery, and indicates a necessity for rehabilitation of plant, so that the present demand may be met and the future requirements may find the producer ready to supply the expanded market which the bountiful crops of the season just past and the general prosperity of the country in general indicate will be continued.

ELECTRICAL SECURITIES FOR THE WEEK ENDING MARCH 16.

New York:	*Closing.*
Allis-Chalmers common	12
Allis-Chalmers preferred	28½
Brooklyn Rapid Transit	55
Consolidated Gas	124
General Electric	147½
Interborough-Metropolitan common	25¼
Interborough-Metropolitan preferred	60
Kings County Electric	127
Mackay Companies (Postal Telegraph and Cables) common (ex-dividend)	69½
Mackay Companies (Postal Telegraph and Cables) preferred (ex-dividend)	68
Manhattan Elevated	136
Metropolitan Street Railway	100
New York & New Jersey Telephone	112
Western Union	81¼
Westinghouse Manufacturing Company	150

The board of directors of the Western Union Telegraph Company has declared a quarterly dividend of 1¼ per cent upon the capital stock, payable at the office of the treasurer on and after April 15 to shareholders of record at the close of the transfer books of March 20. The report of the company for the quarter ended December 31, 1906, is as follows: net revenue, $1,616,791; interest on bonded debt, $332,687; dividends, $1,217,024; previous surplus, October 1, 1906, $16,959,535; total surplus, December 31, 1906, $17,026,616. The estimated net revenue for the March quarter is $1,600,000.

Boston:	*Closing.*
American Telephone and Telegraph	121½
Edison Electric Illuminating	214
Massachusetts Electric	64
New England Telephone	118
Western Telephone and Telegraph preferred	75

The annual report of the Western Telephone and Telegraph Company for the year ended January 31 shows a surplus of $99,670 as against $87,426 for the previous year. The total net receipts were $1,821,754, and the expenditures $799,670, leaving net of $899,670. There was paid in dividends $800,000.

Philadelphia:	*Closing.*
Electrical Company of America	9¾
Electric Storage Battery common	59½
Electric Storage Battery preferred	59½
Philadelphia Electric	7⅞
Philadelphia Rapid Transit	17½
United Gas Improvement	86¾

The directors of the Electric Storage Battery Company have declared the regular quarterly dividend of 1¼ per cent on both common and preferred stocks, payable April 1 to stockholders of record on March 26.

Directors of the United Gas Improvement Company have declared the regular quarterly dividend of 2 per cent, payable April 15 to stock of record March 30.

Chicago:	*Closing.*
Chicago Telephone	117
Chicago Edison Light	133
Metropolitan Elevated preferred	65
National Carbon common	70
National Carbon preferred	115
Union Traction common	—
Union Traction preferred	—

The executive committee of the Chicago Telephone Company has authorized the usual quarterly dividend of 2½ per cent on the capital stock, payable March 30.

TELEPHONE AND TELEGRAPH.

DEXTER, MICH.—Work has been commenced by the Mutual Telephone Company on a line from Dexter to Hamburg *via* Lakewood.

BROCKTON, MASS.—To improve the switchboard at the local exchange of the Southeastern Massachusetts Telephone Company the sum of $7,200 has been appropriated by the company.

COLUMBUS, OHIO—The Cincinnati & Suburban Bell Telephone Company has filed with the secretary of state a certificate of the increase of its capital stock from $5,000,000 to $8,000,000.

PITTSBURG, PA.—On or about April 1 the Federal Telephone Company will move its general offices to rooms 803 and 804 Murtland Building, corner of Smithfield and Sixth avenue, Pittsburg.

DALLAS, TEX.—The Southwestern Telegraph and Telephone Company has announced that in the near future a new South Dallas exchange will be built. The proposed new building will be in keeping with the other late exchanges.

FREDONIA, N. Y.—Preparations are being made by the Home Telephone Company to extend a branch line from its present Cassadaga extension over the Arkwright road to Arkwright Center. This is a thickly settled section, now without telephone facilities.

AVA, N. Y.—At a meeting of the East Ava Telephone Company the directors purchased from the Utica Fire Alarm Telephone Company thirty-six telephones and thirty-eight miles of wire. The line is to be built as early in the spring as the weather will permit.

ATLANTA, GA.—At the annual meeting of the stockholders of the Southern Bell Telephone Company the retiring board of directors was reelected. The newly elected board subsequently organized by reelecting the retiring officers. Only routine business was transacted.

SPOKANE, WASH.—The Interstate Telephone Company, operating lines from Spokane into the Idaho Panhandle, will extend its lines from St. Joe, at the head of navigation, twenty-five miles along the proposed route of the Milwaukee railroad, and work will begin in a short time.

SALT LAKE CITY, UTAH.—At the annual meeting of the stockholders of the Rocky Mountain Bell Telephone Company the retiring directors were unanimously reelected. The new directorate later reelected the former officers. The gross earnings last year were stated to be $1,400,000.

MILWAUKEE, WIS.—The assets of the Standard Telephone and Electric Company have been sold, A. L. von Almen purchasing the exchange at Sheridan, Wis., for $1,735, and E. C. Hennis, Chicago, purchasing the plant in the Johnson Service Company's building for $4,150. No bid was made on the book accounts.

CHARLESTON, S. C.—At the annual meeting of the Chester Telephone Company the old board of directors, consisting of G. B. White, S. D. Childs and R. B. Caldwell, was reelected. G. B. White was reelected president, secretary and treasurer. The report of the president showed that the affairs of the company are in good shape.

WHEELING, W. VA.—A new independent telephone line is to be connected with either the National or Bell lines at Moundsville. The line is known as the Home Telephone Company and is the property of farmers in the interior of Marshall county. They are at present extending the line to Sherrard and hope eventually to put it through to Moundsville.

PORT TOWNSEND, WASH.—The Independent Telephone Company, a corporation composed largely of local interests, has completed construction that now permits telephonic communication between Port Townsend and all points in Clallam county. The company has also completed the construction of a line between Port Townsend and Port Ludlow, and work is now under way on constructing a line to Seattle.

SPOKANE, WASH.—Stockholders of the Potlatch Farmers' Telephone Company, at Leland, decided at a recent meeting to connect with the Potlatch telephone line, of which R. H. Porter, of Juliaetta, Idaho, is manager. This action is considered the most important move in the history of the company. The line has eighteen subscribers, but when the connection is made will have communication with more than 150 farmers surrounding Juliaetta, Kendrick and Cameron, as well as with all long-distance points.

PITTSBURG, PA.—The Federal Telephone Company has discontinued its service in Charleroi and vicinity. Lack of patronage caused this action. The poles and wires have been sold to the West Penn Electric Company, a subsidiary company of the West Penn Railways Company, which operates trolley lines and electric light plants throughout Westmoreland and Fayette counties, and which is extending its service into Allegheny county. The lines so sold are not to be used for telephone service for two years after 1908.

SPOKANE, WASH.—A movement is being discussed at Colville, Wash., north of Spokane, to consolidate all the independent telephone lines in Stevens county, establish exchanges at Chewelah, Colville, Marcus and at Northport, extend short lines to contiguous points along the route of main lines and give an all-night or continuous service, and a rental rate to all subscribers to exclude any toll through the exchanges. In exchange for the franchise privileges on the public highways all county business will be handled free.

SPOKANE, WASH.—The council of St. Johns, Ore., south of Spokane, has granted a franchise to the Home Telephone Company for twenty-five years. The company will pay the city $5,000, at the rate of $200 annually, after it installs its plant. The requirements are free telephones for the city, underground wires in the business section and such other regulations as the city attorney deems necessary for the protection of the city's interests. The petition for franchise by the Pacific States Telephone Company has not been considered.

MILWAUKEE, WIS.—The Wisconsin Telephone Company plans improvements in its system throughout the state and in Milwaukee during the coming summer, and the completion of the underground circuits between Milwaukee and Chicago—the whole to represent an outlay of $1,500,000. At the present time there are in operation in Wisconsin 85,000 Bell telephones, and this number, it is expected, will be increased to more than 100,000 before the close of the year. In Milwaukee the present total is 24,000, and this is being increased, on an average, 1,000 each month.

PORTLAND, ME.—Work has been begun preliminary to making extensive additions to the central office plant of the New England Telephone Company in order to take care of the rapid growth of the Portland exchange. The improvements, which have been specified to be completed early in the summer, include the addition of four large sections to the switchboard. Two of the new sections of the board, each with positions for three operators, are to be for local lines, and the other two, each with positions for two operators, for toll lines. Altogether the cost of these improvements and additions will amount to more than $10,000.

OMAHA, NEB.—At the annual meeting of the Nebraska Telephone Company it was decided to increase the capital stock of the company $2,000,000, giving it a total capitalization of $5,000,000. The company spent over $1,000,000 last year in improvements. Business has increased over thirty-one per cent. The company has 43,000 subscribers on its own lines, with 38,000 on leased lines. The following directors were elected: F. P. Fish, George C. Barton, George W. Holdrege, H. W. Yates, W. W. Morsman, C. W. Lyman, E. M. Morsman, H. Vance Lane and C. E. Yost. The board organized by the election of Casper E. Yost, president; H. Vance Lane, vice-president and general manager, and E. M. Morsman, secretary and treasurer. This year the telephone company expects to connect with the Rocky Mountain system by way of Julesburg and Cheyenne.

DENVER, COL.—At the annual meeting of the Colorado Telephone Company the following officers were elected: E. B. Field, president; E. B. Field, Jr., vice-president and treasurer; H. W. Bellard, secretary and auditor; Roderick Reid, assistant secretary, and E. M. Burgess, general manager. The annual report of President Field contained the announcement that plans for the coming year contemplated the expenditure of $1,500,000 in extensions and improvements. In Denver the company has already acquired real estate for the establishment of additional exchanges in South Denver and Montclair. The telephone company is in a most prosperous condition, as shown by the report submitted by President Field. New construction is going on all over the inter-mountain country, and particularly in Colorado. The growth of the business during the past year demanded the expenditure of $2,000,000.

INDUSTRIAL ITEMS.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., in bulletin No. 1,050, describes and illustrates alternating-current generators of the water-wheel type.

THE SAMSON CORDAGE WORKS, Boston, Mass., has published an attractive catalogue devoted to the Samson solid braided cords. Copies of this catalogue will be sent to any one interested upon request.

THE SIMPLEX ELECTRICAL COMPANY, 110 State street, Boston, Mass., has published a new edition of the Simplex Manual. The company is also distributing a new edition of the Simplex wiring computer.

THE HART & HEGEMAN MANUFACTURING COMPANY, Hartford, Ct., has published a very complete catalogue descriptive of Hart switches and "H. & H." push switches. This catalogue will be sent to any one interested upon request.

DOSSERT & COMPANY, INCORPORATED, New York city, has published a new catalogue descriptive of the Dossert solderless electrical connectors or cable joints for stranded or solid wire. This catalogue will be sent to any one interested upon request.

THE ELECTRIC SERVICE SUPPLIES COMPANY, Philadelphia and Chicago, announces that in addition to the territory of Philadelphia and Chicago which it already controls, it has been given the territory surrounding Pittsburg for the full line of Sterling insulating material. A full stock of Sterling insulating varnish, black plastic insulator, etc., will hereafter be carried in stock at its new Pittsburg warehouse.

THE H. W. JOHNS-MANVILLE COMPANY, 100 William street, New York city, has ready for distribution some literature devoted to "Electrobestos" arc deflectors. These deflectors are manufactured under an enormous pressure, giving to the material great density and tensile strength. They are regularly made for most of the standard railway controllers, and can be furnished to order for any special types of controllers.

THE F. WESEL MANUFACTURING COMPANY, 70-80 Cranberry street, Brooklyn, N. Y., has decided to dispose of its engine room, having recently installed Edison current. The mechanical equipment includes engines, generators and a Gould storage battery. The plant was installed only a little over a year ago, and the machinery offered is as good as new. The outfit is open for inspection, and can be seen at any time at the Wesel company's plant.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has issued a new series of descriptive bulletins. This series includes No. 4,485, portable gasolene engine and generator outfits; No. 4,487, small plant continuous-current switchboard panels; No. 4,488, Thomson recording wattmeters, type C-6; No. 4,489, crane wiring supplies; No. 4.490, portable air-compressor set; No. 4,691, controllers for power and mining service; No. 4,492, small plant alternating-current switchboards for 1,150 and 2,300 volts. The company has also ready for distribution an addenda sheet to catalogue and price list No. 7,545; price list 5,162 on Thomson recording wattmeters, and a new general index to bulletins.

THE JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., has published a handsome and comprehensive book entitled "Crucibles—Their Care and Use." The author of this work is John A. Walker, vice-president, treasurer and general manager of the Joseph Dixon Crucible Company. The purpose of the book is to instruct users of crucibles as to their proper use and the dangers of abuse of crucibles. It tells what graphite is and why crucibles are made of this material. The book also gives much information, such as the proportions of metal in commonly fused alloys, and tells the freezing, fusing and boiling points of various substances. The illustrations supplementing the text are interesting and instructive.

Record of Electrical Patents.

Week of March 12.

846,464. TELEGRAPHIC INSTRUMENT AND THE LIKE. Alberto Gentili, Veneto, Italy. Two contact rollers are attached to the tip of the key.

846,469. CIRCUIT-BREAKER. Rudolf E. Hellmund, New York, N. Y. The locking ratchet is opened by a weight.

846,477. OIL-PROOF ELECTRICAL INSULATING COMPOUND AND METHOD OF MAKING SAME. John J. Kessler, Jr., St. Louis, Mo. The insulating material is mixed with linseed oil.

846,479. TELEPHONE. Stanislaw A. Koltonski, Boston, Mass., assignor to Electric Gas Lighting Company, Boston, Mass. A hook-switch.

846,480. PROCESS OF ELECTRIC WELDING. Laurence S. Lachman, New York, N. Y., assignor to Standard Pulley Manufacturing Company. A process for welding thin and thick sheets together.

846,515. ELECTRICALLY ACTUATED CLOCK. Ruben W. Smedberg, St. Peter, Minn. A ratchet-driven clock.

846,521. ELECTRIC FURNACE. Le Roy W. Stevens, Syracuse, N. Y., assignor to Advance Furnace Company of America, Utica, N. Y. A continuous feed furnace.

846,522. POLARIZED ELECTRIC SIGNAL BELL. William M. Thomas, Chicago, Ill., assignor of one-half to Otto Eisenschiml, Chicago, Ill. The ringer is enclosed in the gong.

846,533. ELECTRIC CONTROLLER. Ferdinand Volk, Pittsburg, Pa., assignor of one-sixth to Casper J. Pollman, Pittsburg, Pa. A device for limiting the motion of the controller to one step at a time.

846,544. ELECTRIC HEATER. Albert H. Bremer, William J. Chattin, and August H. Hoenisch, Philadelphia, Pa. An electrically heated boiler.

846,557. TELEPHONE TRUNKING SYSTEM. Francis W. Dunbar, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. A guard signal is connected to the incoming end of the trunk.

846,566. HIGH-TENSION DIRECT-CURRENT ELECTRIC SYSTEM. John S. Highfield, London, England. A grounded series system.

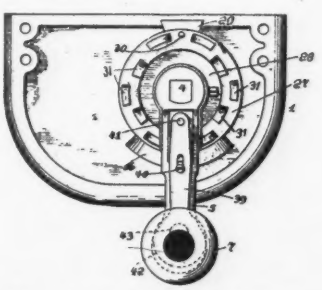
846,590. HOOK-SWITCH. Charles T. Mason, Sumter, S. C., assignor to the Sumter Telephone Manufacturing Company, Sumter, S. C. A method of construction.

846,624. DEVICE TO DISCLOSE OPENING OF THE SHUNT-CIRCUITS OF ELECTRIC METERS. William L. Saunders, Denver, Col., assignor of two-thirds to Daniel K. Hickey, Denver, Col. A signal controlled by a magnet in the shunt circuit.

846,625. ELECTRIC SWITCH. Harry Sawyer, Muskegon, Mich. A knife-switch.

846,626. CONTROLLER FOR ELECTRIC MOTORS. Frederic Schaefer, Wilkinsburg, Pa. A variable voltage transformer.

846,628. TELEPHONE-EXCHANGE APPARATUS. Edwin H. Smythe, Chicago, Ill., assignor to Western Electric Company, Chicago, Ill. A coin collecter.



846,533.—ELECTRIC CONTROLLER.

846,642. PROCESS OF REDUCING METALLIC SULFIDS. Edward L. Anderson, St. Louis, Mo., assignor, by direct and mesne assignments, of one-half to himself and Harvey Atchisson, St. Louis, Mo., and one-half to John H. Miller and Chalon G. Cloud, McLeansboro, Ill. The ore is treated electrolytically.

846,672. HIGH-PRESSURE ELECTRICAL APPARATUS. Franz J. Koch, Dresden, Germany. A transformer for therapeutic purposes.

846,673. ELECTRIC SWITCH. Andrew Koesche, Chicago, Ill., assignor to the Liquid Carbonic Company, Chicago, Ill. A quick-break switch.

846,684. CIGAR LIGHTER. James H. Moore, Portland, Ore., assignor to Moore Electric Cigar Lighter Company, Portland, Ore. A step-down transformer for heating the igniting element.

846,691. THERMAL CUT-OUT FOR ELECTRIC CIRCUITS. Gwynne E. Painter, Baltimore, Md. An enclosed fuse-block.

846,693. ROTATING MAGNET FOR DYNAMO-ELECTRIC MACHINES. Charles A. Parsons, George G. Stoney, and Alexander H. Law, Newcastle-upon-Tyne, England; said Stoney and Law assignors to said Parsons. The field is carried on an elliptically shaped shaft.

846,701. SOCKET. Ray Smith, Elkins, W. Va. A method of constructing a key socket.

846,703. SYSTEM FOR THE SUPPLY OF CURRENT DEMANDS. Frank W. Springer, Minneapolis, Minn. A primary battery system and means for depolarizing.

846,764. SWITCH. William R. Thompson, South Norwalk, Ct., assignor of one-half to King W. Mansfield, Norwalk, Ct. A trolley-wire switch.

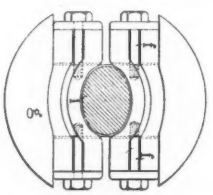
846,779. SIGNALING APPARATUS. Clarence W. Coleman, Westfield, N. J., assignor to the Hall Signal Company, Maine. An electrically controlled, fluid-operated signal.

846,809. SPARK-IGNITION SYSTEM FOR EXPLOSION ENGINES. Richard Varley, Englewood, N. J., and Archibald D. Scott, Providence, R. I., assignors to the Autocoil Company. A rotary distributor controlling a plurality of spark-gaps.

846,810. IGNITER SYSTEM. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. A plurality of sparks and means for closing them successively.

846,811. IGNITION SYSTEM FOR EXPLOSION ENGINES. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. Employs a plurality of vibrator induction coils.

846,827. TELEPHONE-SERVICE APPARATUS. Samuel H. Couch, Boston, Mass., assignor to Superior Automatic Telephone Company, Boston, Mass. An auxiliary switch for telephone instruments.



846,693.—ROTATING MAGNET FOR DYNAMO-ELECTRIC MACHINE.

846,853. ELECTRIC HEATER. James T. Howell, Seattle, Wash. A resistance element threaded through a glass tube, the glass tube being placed within a metallic sheathing and bent into a desired form under the influence of heat.

846,889. TELEPHONE SYSTEM. Albert K. Andriano, San Francisco, Cal., assignor to Direct-Line General Telephone Company, San Francisco, Cal. A common return system.

846,912. CLUSTER SOCKET. John H. Dale, New York, N. Y. A cluster for incandescent lamps.

846,960. CIRCUIT-CLOSING MECHANISM. Thomas W. Small, Cleveland, Ohio, assignor, by mesne assignments, to the Acme Automatic Street Indicating Company, Cleveland, Ohio. Contacts are made successively by means of a screw-driven arm.

846,969. SHUNT FOR ELECTRIC CIRCUITS. Maurice J. Wohl, New York, N. Y., assignor to Victor Electric and Manufacturing Co. The resistance element is clamped in large metallic terminals.

847,003. ELECTRIC FURNACE. Basilius von Ischewsky, Kiew, Russia. A cylindrical, rotatable furnace.

847,007. ELECTRIC SWITCH. Isidor Kitsee, Philadelphia, Pa. A locking switch

847,008. CONVERTER. Isidor Kitsee, Philadelphia, Pa. Primary and secondary windings are placed on a third coil, also used as a transformer circuit.

847,044. THERMOSTATIC CIRCUIT-CONTROLLING DEVICE. Louis H. Britton, Cleveland, Ohio. Employs a vacuum chamber.

847,079. ELECTROMAGNETIC TRANSMITTING DEVICE. Max Johannet, Paris, France. Motor and generator armatures are mounted on the same shaft, the field excitation of the latter being adjustable.

847,087. ELECTRIC SWITCH. Gustav W. Liden, New York, N. Y. A switch locked by a ratchet.

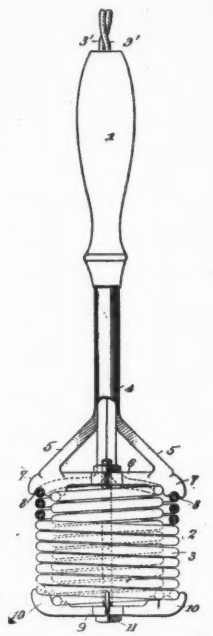
847,088. VARIABLE-SPEED ELECTRIC MOTOR. John C. Lincoln, East Cleveland, Ohio, assignor to the Lincoln Company, Cleveland, Ohio. Variations in speed are produced by means of a laterally positioned magnetic system beyond the fields.

847,105. SIGNAL. William H. Parrish, Jr., Nashville, Tenn. A signal system for crossings.

847,111. STARTING RESISTANCE FOR MOTORS. Henry G. Reist, Schenectady, N. Y., assignor to General Electric Company. Resistance-bobbins are mounted on the rotor.

847,153. ALTERNATING-CURRENT MOTOR. Ernst J. Berg, Schenectady, N. Y., assignor to General Electric Company. A split-phase induction-motor.

847,163. TROLLEY. Thomas Cope, McKees Rocks, Pa. A ball-bearing trolley.



846,853.—ELECTRIC HEATER.

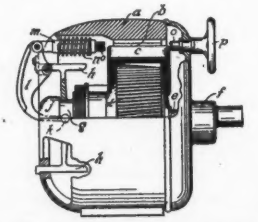
847,170. TROLLEY STAND. Harry E. Eastman, Richmond, Va., assignor to Louis Goldback and Edward W. Krouse, Richmond, Va. An adjustable trolley stand.

847,172. CONTROLLING MEANS FOR SINGLE-PHASE MOTORS. Augustine R. Everest, Lynn, Mass., assignor to General Electric Company. A method of phase splitting.

847,188. TELEGRAPHY. Isidor Kitsee, Philadelphia, Pa. An electromagnetically driven escapement wheel.

847,189. ELECTRIC TELEGRAPHY. Isidor Kitsee, Philadelphia, Pa. A relay with two coils, one terminal of each being connected to the line, a connection to the intermediate point is arranged for shunting either coil.

847,197. RELAY. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. The flux-bar extends longitudinally beyond the coil.



847,088.—VARIABLE-SPEED ELECTRIC MOTOR.

847,283. TELEPHONY. Harold J. Fisher, Hotchkiss, Col., assignor of one-half to George H. Duke, Hotchkiss, Col. A selective telephone system.

847,284. COMMUTATOR. John R. Grindrod, Lynn, Mass., assignor to General Electric Company. Commutator bars and insulating members are tapered inversely.

847,299. CIRCUIT-MAKING AND BREAKING DEVICE. Frederick L. Willard, New York, N. Y., assignor of one-half to George Weiderman, New York, N. Y. The brake is held in the closed position by a magnet.

847,303. ELECTRICAL CONDUCTOR. Frederick Platt, Lynn, Mass., assignor to General Electric Company. A carbon brush with attached flexible conductor.